THE
ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE ELECTRICAL INDUSTRY AND NEXT YEAR'S EXHIBITIONS.

IT is to be presumed that most people are aware that next year there is to be held in London what is known as a Franco-British Exhibition, perhaps in some respects very opportune, and no doubt likely to bring credit and profit to the promoters; but, as far as we have studied the prospectuses and advertisements of this Exhibition, the main object is to amuse the public, and this will be accomplished by a grand athletic meeting, motor-car races, raree shows and a thousand and one things, which, given fine weather, will prove marvellously attractive. No one could seriously quarrel with such a programme; but the organisers are not satisfied to run the Exhibition frankly as a place of amusement; they seek to give a serious turn to the entertainment by prevailing upon the engineering industries to take space, in order to show the public that there are more things on earth than flying machines and shooting ranges. Probably the idea is a commendable one; amusement and instruction combined always was attractive to some people, and the Franco-British Exhibition seems to be based on that notion. At any rate, the promoters of the Exhibition have been astute enough to induce the Institution of Electrical Engineers to ask the electrical industry to take part in the coming show. While one recognises the good intentions of the Institution towards the electrical industry, we are afraid that on this occasion they are utterly misplaced. No doubt the official patronage may be the means of inducing some electrical manufacturers to woo the attention of the public, but we think the action of the Institution is liable to be misunderstood. If the Institution before committing itself to a direct association with what we consider is intended primarily as a place of amusement, had consulted the large manufacturing concerns as to the possibility of their becoming exhibitors, it might have saved itself from occupying a rather invidious position. It seems hardly consonant with the dignity of the profession that the official heads should be driven to hawking space among manufacturers, yet this is practically what the Institution is doing, and if the appeals to the industry are not successful—and we do not think they will be—the President and Council must surely feel somewhat humiliated. It will be argued that other engineering societies are doing precisely what we complain of in the Institution of Electrical Engineers, but that proves nothing except the cleverness of the promoters of the Franco-British Exhibition. There have been many attempts at Earl's Court to introduce a serious element into the annual entertainment, and some two years ago on the occasion of the Naval and Fisheries Exhibition there were most interesting exhibits of the mechanical side of shipbuilding and armaments, but from our own observation the public displayed the most lethargic interest in them. All this shows that when the public goes to Earl's Court and similar places it is with the definite object of being amused, and so the promoters of the new Exhibition, with the experience they have gained at Earl's Court and other places, are not likely to make the mistake of providing an entertainment which is too serious for the popular taste. There is, as far as we can learn, a great wealth of space at the new

Exhibition, and the authorities are naturally desirous of having this occupied at as little cost as possible to themselves, but the *raison d'être* for showing mechanical and electrical engineering plant is hard to find. The organisers of the Exhibition are utilising the good relationship which exists between this country and France to further their schemes, and probably next year there may be numerous visitors from the Continent, but while they may appreciate the efforts to provide amusement, they will buy neither mechanical nor electrical machinery, and it would be idle to suggest that the English people are likely to be influenced one way or the other. No doubt exhibitions have a useful part to play in helping the commercial development of electrical business, but we think that most firms are beginning to realise that to secure work, either at home or abroad, they must not be content with enterprising displays at exhibitions at home, but must send out competent and energetic salesmen. In our opinion, next year's Franco-British Exhibition can be of very little value to the electrical industry, and it is to be deplored that our Institution should have permitted itself to become the amiable catspaw of a group of clever promoters of exhibitions, especially when a more direct project from the point of view of the electrical industry is on foot.

An undertaking which seems to us to merit more serious attention from the electrical trades, and especially those having to do with electric light and power development, is that of which we are now able to announce a few particulars. It is to be held in the Manchester district next year, and will be run largely on the lines so successfully followed at Olympia in 1905, as to period of the year, length of run, division of profits, &c. It will enjoy the co-operation of electricity suppliers, municipalities and power distribution companies, electrical manufacturers, electrical contractors, and all who are concerned in the particular lines of development to which we have referred. It will be observed that this is precisely the line of action that we advocated in our issue of July 12th. It will also be remembered that at the annual meeting of the Manufacturers' Association it was clearly shown that, whether the members of that Association said yea or nay, an Exhibition in the locality of Manchester there was to be. The Manchester and Salford Corporations have now definitely decided to hold the exhibition in their district, under their direct patronage and substantial support, in or about October, 1908. Arrangements are being made to call a meeting at an early date of Corporation officials and supply companies' representatives in the North of England, who are interested in the matter. A general advisory committee will then be appointed, also an executive committee, to assist in the carrying out of the scheme in detail.

The executive committee will consist of representatives from Corporations supporting the scheme, supply companies, representatives of the Municipal Electrical Association, the National Electrical Manufacturers' Association, the Electrical Contractors' Association, and representatives of the exhibitors.

Profits arising out of the Exhibition will be allocated to exhibitors and donators, and grants will be made to benevolent funds connected with the electrical industry and an institution which shall be nominated by the Manchester and Salford Corporations, and situated in their respective districts.

Mr. S. L. Pearce and Mr. V. A. H. McCowen, Corporation electrical engineers of Manchester and Salford respectively, have consented, with the approval of their chairmen, to act as consulting engineers to the scheme.

Mr. C. S. Northcote, deputy chairman of the recent Olympian Exhibition, will act as general manager to the executive committee, and Mr. W. Davenport will act as organising secretary. It is intended that as soon as the final details of the scheme are a little more advanced, the electrical trade shall be asked to attend a meeting to appoint its representatives and to approve of the preliminary arrangements. Negotiations are at present proceeding for a suitable site, of which full particulars and plans will in due course be published.

We think we have said sufficient to show that in October, 1908, Manchester will be the place for the electrical trades exhibitor rather than the Franco-British show.

Light Railway Orders, 1906.

The annual report of the B. of T. on the proceedings of the Light Railways Commissioners during 1906 was issued in July, and a glance at one of the tables reveals the fact that the stagnation which coincided with the two years of depressed trade conditions in 1904 and 1905 gave place in 1906 to a sudden return to briskness. The year 1901 marked the zenith for numbers of orders confirmed, for mileage covered by those orders, and, naturally, for the amount of the estimated cost of construction. In 1902 the estimates were reduced from 2·6 million to 1·2 million, but 1903 saw a slight improvement, which was followed next year by a regular slump to 0·8 million pounds, while in 1905 the bottom was reached at 0·3 million, this being hardly more than the estimates for the orders confirmed in the year after the Light Railways Act was passed. Returning trade seems to have given a fillip to the construction of light railways, for last year's estimates multiplied by four those of the year preceding.

Looking now at the columns headed Applications the prospects for the current year are not so bright. In 1906 the number of applications for orders was the lowest ever made, having dropped from 89 in 1898 to 25, the decrease since that mad time being almost unbroken. Even in 1896 the applications were three more than last year, and the estimates were almost three times as great. With so few applications last year the orders confirmed in 1907 will be less than ever, if the figures of the last decade are safe criteria, and the outlook is not so rosy as when viewed in the light of the increase under orders confirmed.

The Light Railways Act, in spite of its grudging and unfair terms, tempted promoters to rush for what are termed in the United States "franchises," and their disillusionment, together with the general decline in the prosperity of the country, is graphically pictured in the columns of figures before us. In spite of the lugubrious preaching of tariff reformers prosperity is returning, but nothing like the activity of the middle of the nineties will be seen in the light railway industry until legislation more attractive to capital finds its way into the Statute Book.

A Model Specification.

We have from time to time pointed out the injustice of the stipulations to which contractors are required to submit by consulting engineers, some of whom appear to regard the former not as equal parties to a bargain, but as harpies whose chief aim is to shirk their obligations and to extort the maximum amount of plunder from their victims. Acting upon this assumption, and apparently regarding the resources of the law as inadequate to cope with the insidious wiles of such unscrupulous monsters, they proceed to constitute themselves the sole arbiters of right and wrong, declaring that the contractors are outlaws and unworthy to be heard before a court of justice. As a matter of fact, the average contractor is as honest as the average consulting engineer, and his rights are every whit as just as those of the purchaser; the consulting engineer owes a duty to both parties, and is bound in honour to see that each receives his due.

We are glad to think that of recent years a considerable improvement has taken place in this respect; but that there still remain exceptions is brought home to us by the perusal of a specification issued last month, for the supply of motors for twelve months to a provincial municipality. In this case the specification was signed by the borough electrical engineer. The contractor was to keep the Corporation supplied with at least one motor of each size (ten sizes) for stock, and was to receive no payment for them until they were sold or let on hire. The specification made the engineer's decision final and binding in all matters relating to the contract, without resource to any legal or other process, and included the following astounding clause:—

In case the terms of this Contract be not duly performed by the Contractor, the Corporation shall be at liberty at any time to terminate the Contract and make such other arrangements as they

think fit, and the Corporation shall be at liberty to demand, and the Contractor shall pay to the Corporation on demand, a penalty of £200. The decision of the Engineer in this matter shall be final and binding by both parties without appeal to any Court or process whatsoever.

We do not know that we have ever met with a more iniquitous proposition. Should the engineer, as supreme arbiter and oracle of justice, at any time and for any reason choose to decree that the terms of the contract have not been fulfilled, the contractor is to pay £200 and "clear out," without right of appeal!

As a matter of fact, we believe that a penalty clause of this nature is invalid before the law, and the clause, therefore, is merely an empty threat; but that does not affect the spirit of the thing. It is pure tyranny.

Tramways and the Postmaster-General.

In the model order for electric tramways and light railways, the lines of the Postmaster-General are guarded scrupulously from interference arising from the working of electric tramways within a mile of those lines, and great has been the cost of erecting guard wires and other so-called safety devices to prevent strong currents passing through the wires and delicate instruments of the Post Office telegraph service. We have contended always that the erection of guard wires and the like is not the proper way to deal with the defects of telegraph lines, and our arguments are too well known to need repetition.

Briefly, we hold that the Post Office should acknowledge the equal right of the tramways to own and use overhead wires, and should recognise that telegraph lines must be constructed with due regard to the dangerous consequences of the wires falling across trolley wires.

The Postmaster-General, having discovered for himself the disadvantages of guard-wires to everyone concerned, has sought for some time to force the owners of tramways to pay for the insertion of heat coils and fuses in all circuits which approach or cross trolley wires, and in some cases he has been successful; but the majority have resisted his demands. The latest announcement on the matter is that after lengthy negotiation and discussion a request has been sent to the B. of T. to appoint an arbitrator to settle the point.

A New Trolley Pole Retriever.

Although the extent of the annoyance and damage caused by de-wired trolley wheels has been sufficiently serious at any time during the past decade to demand the general use of some contrivance, which will not only prevent the pole rising above some predetermined height, but will drop it instantaneously below the trolley wire and its attachments; the success of the devices which have been tried from time to time is not conspicuous, and it is a fact that in very few cases is any effort made to control effectively the upward movement of the pole. We recollect describing at the time of the last Tramway Exhibition more than one ingenious invention which gave us some ground for hoping that tramway managers at last had the means at hand to lessen the considerable risk which an uncontrolled trolley pole always carries, but we are disappointed.

Why these and other inventions did not "catch on" we cannot say; but it is possible that the mechanism by means of which the pole first automatically falls, then is brought back into work, was too complicated or too delicate for the hardships encountered in the daily life of a tramway.

We observe another wave of advocacy of the sliding bow approaching, impelled, as before, by Continental engineers, who have obtained satisfactory results with it in long-continued service. These writers desire particularly to see the bow used in England, because it would reduce to a minimum the accidents which are all too common with the trolley, and would simplify overhead construction at curves and junctions, this being particularly desirable in our larger towns.

Undoubtedly the advocates of the sliding bow have a strong case so long as the centre running trolley wheel attached to a pole which does not retrieve when occasion requires is in common use; but that case must be weakened proportionately as the moderately side-running wheel, which drops out of danger directly it jumps, grows in favour.

In another column attention is drawn to the latest retrieving device, which presents considerable merits, at least on paper. The crucial test, of course, must be the one of long use, and it is not only necessary that the pole shall be retrieved every time, but the added parts of the trolley standard must not add materially to the working costs, especially in these days of a vanishing margin of net profit.

The Motor-'Bus.

Our text is taken from two newspaper cuttings, dated July 23rd and 29th respectively. The first in order of date concerns a deputation from the City and Borough Councils of London, which waited on the Commissioner of Police with reference to the nuisance caused by motor vehicles. The Commissioner recognised the serious nature of the complaints, and agreed in spirit, if not in actual words, with the hope of the deputation that a Traffic Board would be appointed to regulate such matters as the routes taken by heavy motor-cars. "Some authority" was as near as he allowed himself to go, and that authority should not be the Commissioner of Police, who, we may assume, is harassed enough with his responsibility for noise, reckless driving, overcrowding, the emission of smoke or steam, and the dripping of grease.

In his opinion, a steady diminution in the noise made by motor-cars is being effected, and he has a reasonable hope that omnibuses may become satisfactory vehicles in all respects. He agrees that a lighter 'bus than those now running is desirable, but points out that the electrobus which has just been sanctioned is 50 per cent. heavier. The vigilance of the police in matters of noise and other nuisances has not been relaxed, and the weighty deputation at least will not have induced the Commissioner to lighten the responsibilities of the companies towards the public.

Our second cutting is from the *Times* Commercial Supplement, which is in the same boat with ourselves as having warned investors time after time that there were no fortunes to be made by following the balloon-headed lead of newspapers which have to pay £50,000 now and again for the privilege of saying absurd things in exaggerated language.

The illusion has lasted about two years, and at the pricking of the bubble no one is to be hanged, which seems a pity, especially as the engineering profession is so overfull.

The controversy which raged in our columns under the title Tramcar *v.* Motor-'Bus was notable for the ease with which experts demonstrated that the total cost of working a system of motor-'buses must be less than that of an electric tramway, although the working costs *might* be slightly higher. Since then the motor-'bus has been given every opportunity to overwhelm the tramcar by its cheapness, but nobody thought it worth while to publish figures which could be taken seriously, until the auditor of the London Power Omnibus Co. stated at the meeting on July 22nd, when liquidation was decided upon, that the company had paid considerably over 1s. 6d. to earn 11d. In our issue of February 24th, 1905, we said we believed that the cost of operating petrol 'buses would certainly not fall far short of 1s. per car-mile, and might be considerably more. At that time petrol was much cheaper, and reliable data as to the cost of repairs were unobtainable. Under the circumstances, we think our estimate has been fully justified by the event.

At the end of last month, in spite of the recent revelations, the prospectus of the "Motor-'Bus and Traction Co. of Ireland, Ltd.," was issued, offering 100,000 ordinary shares of £1 each for subscription. The receipts per car-mile are estimated at 1s. 1d., and the total expenses are not to exceed 10d., including depreciation. The net profits—on paper—are magnificent. We doubt, however, whether the promoters will find the natives of the Emerald Isle as verdant as they seem to anticipate.

THE ELECTRIC DRIVING OF RING SPINNING MACHINES.

By ENRICO BIGNAMI.

Of all the machines employed in the textile industry, the ring spinning machines have received the most attention in connection with electric driving, whether it be because they represent the most important factor in the operations of a modern spinning mill, or because their nature renders them particularly suitable for driving by electric motors.

Messrs. Brown, Boveri & Co., of Baden, who from the commencement had devoted special attention to the application of electric driving to textile mills, sought to extend their experience in this direction with regard to the starting of the motors of ring machines, the mode of construction of the motors which would ensure the maximum reliability of running, and a simple means of regulating the speed of the motors, and consequently of the spinning machine, which should to the utmost possible extent satisfy the exigencies of this kind of service.

The experiments which were carried on were subject to two conditions, namely, that the machines should be driven directly, without the intermediary of speed-reducing gear; and that if possible either three-phase or single-phase alternating current should be employed. The latter condition was due to the simplicity of construction of A.C. as compared with D.C. motors, whilst alternating current also possessed important advantages in the case of transmission of power of great magnitude or from a great distance.

It was not considered practicable in the first instance to couple the three-phase motors directly to the spinning machines, for they ran at an invariable speed, whilst the mill-owners pointed out that it was necessary to drive the machines at two different speeds, according to the kind of thread that it was intended to produce. The motors were, therefore, bolted to the ceiling of the spinning-room, and the ring machines were driven by means of belts, the different speeds required being obtained by changing the pulleys. The motors had squirrel-cage rotors, and were made of the open type to secure simplicity and cheapness of construction. To start the ring spinning machines, the fast-and-loose pulley arrangement was adopted, the belt being gradually transferred from one to the other.

The obvious drawbacks to this system, however, soon led to the conclusion that it would be better to couple the motors directly to the machines, and to enclose them completely, to prevent the access of dust, &c., to the interior. The shells of the motors were provided with external ribs to assist in dissipating by radiation the heat generated in the interior of the machines. In later installations it was found desirable to adopt motors provided with internal ventilation in order to reduce the cost; the air required for this purpose was not derived from the air of the workroom, but was drawn in by the motors from the exterior of the building through special conduits, connected to the shells of the motors; these conduits were also utilised to enclose the conductors leading to the motors. Fig. 1 shows a number of motors in position, and fig. 2 is a side view of one of them, showing the starting apparatus.

In the construction of the motors last mentioned, no provision was made for regulating the speed, as this had not been called for by the manufacturers, who did not anticipate that they would have to produce different kinds of thread with the same ring spinning machines.

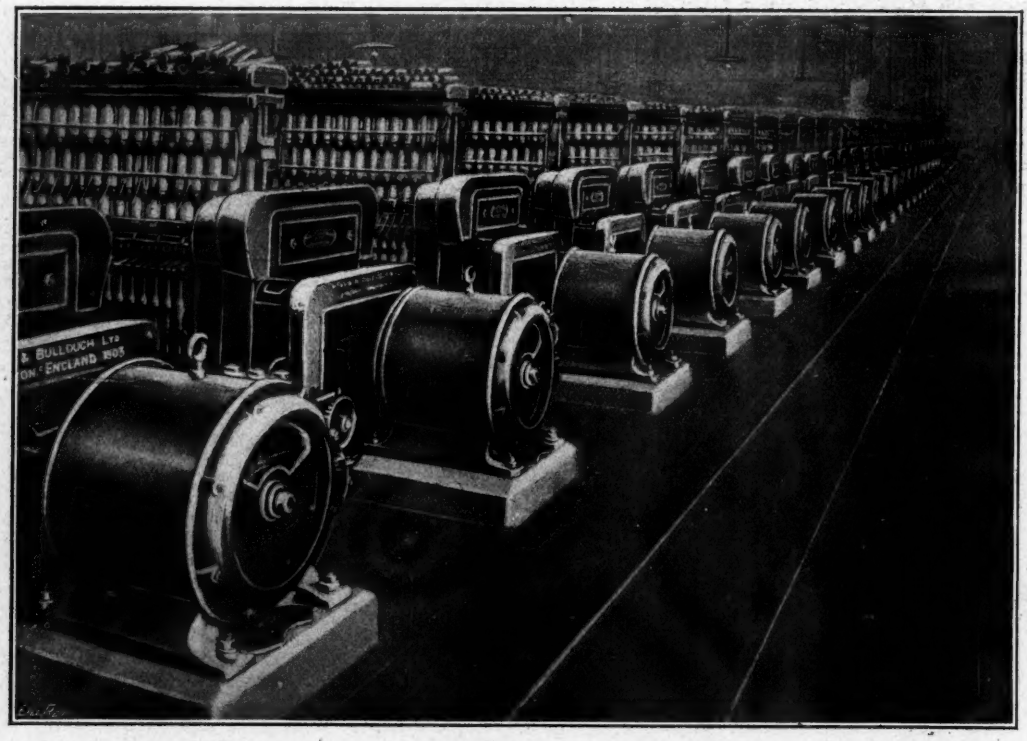


Fig. 1.—Ring Spinning Machines Driven by Three-Phase Enclosed Motors, with Starting Apparatus Attached.

It was at this stage of the development of the system that experiments were begun with a single-phase motor, the construction of which had been studied by Messrs. Brown, Boveri for some time, with a view to various practical applications. The main feature of this motor is that the speed of revolution can be varied between wide limits by means of a simple displacement of the brushes, effected by the operation of a lever, without materially affecting the efficiency of the motor. The latter is illustrated in figs. 3 and 4.

In these experiments a special object was to ascertain the highest speed at which ring machines could be run, so that, whilst not increasing the number of breakages, or in any way reducing the quality or uniformity of the thread or of the winding, a material increase in the average output of the machines could be effected.

The result of the first series of tests was to show that the period of acceleration of the machines must be as brief as

possible, whilst the increase in speed must be effected as far as possible without jerks.

This much ascertained, the later experiments bore upon the influence of the initial speed, during a period of about two minutes; and it was found that as the natural result of an increase of speed beyond the normal value, the thread was broken more frequently, while with a lower speed breakages were less frequent.

In these experiments the normal speed was 650 R.P.M. at the shaft of the drum; on reducing the speed during the first two minutes to a value between 500 and 550 R.P.M., the frequency of the breakages notably diminished, so that in one case they amounted only to a maximum of 1 to 5 in 250 spindles. On further reducing the speed from 500 to 350 R.P.M. the conditions were not materially changed. The most suitable speed was therefore settled at 500 to 550 R.P.M. for the first two minutes, after which one could reach without difficulty the maximum speed permissible.

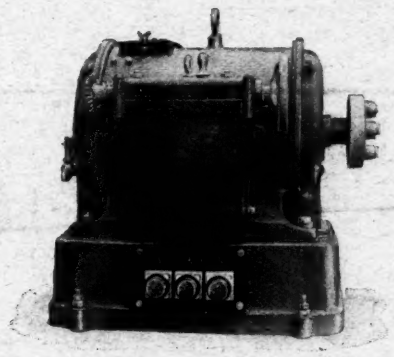


FIG. 2.—THREE-PHASE 7-H.P. MOTOR FOR DRIVING RING SPINNING MACHINE.

The Motor is completely enclosed, and is provided with ventilation from below by means of piping. Starting rheostat, switch and fuses are attached.

In the experiments at 550 revolutions the brushes were simply moved to a position which we may call No. 1, at which the motor always gave the same speed.

During the following period of spinning, of which the duration was from 10 to 12 minutes, the speed was raised to 750, or even 785 R.P.M., and observations were made of the number of breakages of the thread, its quality, and the winding of the spindles. With this increase of speed no greater frequency of breakage was observed than at the normal speed, nor was there any variation in the quality; on the other hand, the winding on the spindles became a little more compact, a quality which is much appreciated by the spinner.

It was found possible also to accomplish a further increase of speed during a short period of time without developing any detrimental effects, and as the result it was settled that the maximum normal speed was 785 R.P.M. This speed was obtained by displacing the brushes to position No. 2, in which the single-phase commutator motor was regulated so as to give the desired number of revolutions per minute, neglecting some negligible oscillations. It was ascertained, further, that it was advisable to reduce the number of revolutions during the last two minutes to 650 or 600. This speed corresponded to position No. 3 of the brushes of the motor, and the three positions above mentioned were marked on the motor once for all.

The stoppage of the machine must be effected in such a manner that it occurs at the moment when the "ring slider" is brought by hand to its lower position; when this position is reached, the spindles must wind a further four turns at their base. If the machine stops too soon, it is necessary to start it again for a short time; with belt driving this is done by shifting the belt for a minute from the loose to the fast pulley. The stoppage, as well as the short following movement, is effected with every facility with the single-phase motor; for the former, the brushes are simply brought to the stop position, and for the latter they are again displaced to the required extent.

Although, in the motor employed for these experiments, the inertia of the rotor was very considerable and abnormal in comparison with the resistance of the friction of the 250 spindles, no difficulty was experienced in stopping the motor in the desired manner by shifting the brushes to the proper position. The motor has an initial starting torque of 2½ times the normal, and the efficiency of the 10-H.P. size, for 500 volts at 50 cycles per second, is at full load 85 per cent., the power factor being 0·89.

Experiments were undertaken for comparative purposes, observing the number of breakages of threads in a machine running at constant speed (650 R.P.M.), and in one driven by the single-phase motor at variable speed. The results were in favour of the variable speed, for it is unquestionable that, by a suitable variation of speed, one can secure a material increase in production, without demanding special qualities on the part of the operatives, the variations of speed required being capable of being automatically effected in a simple manner by the spinning machine itself.

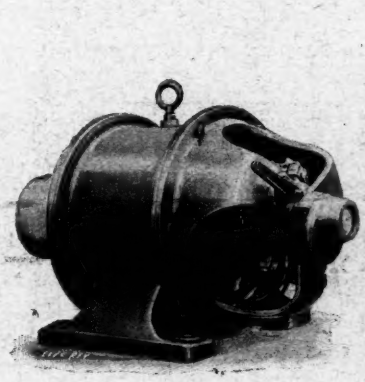


FIG. 3.

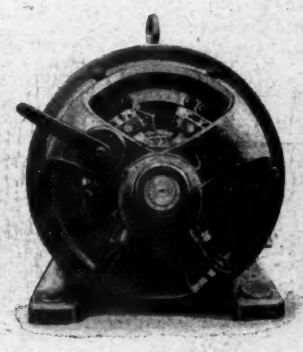


FIG. 4.

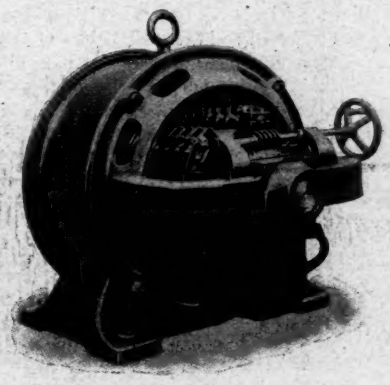


FIG. 5.

FIGS. 3 AND 4.—SINGLE-PHASE COMMUTATOR MOTOR OF 5 H.P., 1,000 R.P.M., WITH ARRANGEMENT FOR DISPLACING THE BRUSHES, ACTUATED DIRECTLY BY THE RING SPINNING MACHINE.

FIG. 5.—SINGLE-PHASE MOTOR OF 10 H.P., 700 R.P.M., WITH HAND REGULATION.

If electric driving by means of a separate motor for each machine has not hitherto been generally adopted, it is due to the fact that it is more costly than an ordinary system of transmission. Now, however, thanks to the special advantages obtained by the arrangement above described, it is probable that the separate driving of ring spinning machines will very soon increase, in view of the fact that the initial increase in cost of the installations will be very quickly covered, and that single-phase motors can be readily applied on any A.C. system, provided that in the case of three-phase supply they are equally distributed between the three phases.

D

THE MERCURY VAPOUR LAMP AS A FACTOR IN ELECTRICITY SUPPLY DEVELOPMENT.

[COMMUNICATED.]

ALTHOUGH the mercury vapour lamp has now been before the public in thoroughly practical forms for some years, and has amply demonstrated its intrinsic and economical merits for what may be termed its own class of work, it is a factor in electricity supply development of which full advantage has certainly not been taken. The metallic filament lamp, the flame arc, and similar economic improvements have been readily seized upon as affording valuable means for combatting the gas interests; if the subject be looked into, the mercury vapour lamp, although perhaps scarcely recognised as such in this country, will be found to be an equally trenchant weapon in its proper sphere. Exactly where this begins and ends is difficult to define, as so much depends upon individual taste. We may safely assume, however, that an efficiency approximating to 0·5 watt per candle is desirable in every instance, and the main question, therefore, resolves itself into, at what point do æsthetic or practical objections to the colour of the light outweigh its wonderful economy? It is this colour difficulty that has always stood in the way of the mercury lamp to some extent; manufacturers do not seek to excuse the fault, but they quite correctly point out that a very wide field exists in which the correct rendering of colour values possesses no importance, being subordinated to the main considerations of efficiency in lighting and low cost. To treat first of the question of colour: the light emitted by the mercury vapour lamp is almost entirely devoid of red rays, its spectrum being composed of yellow, green, blue, violet and ultra-violet. For this reason, red objects under this light assume a purple hue, tending towards black, while green, blue and violet appear more natural, although distorted to some extent. Obviously, for many purposes such a light is impossible; for instance, it is not suggested that it would be suitable for a ballroom or any position where flesh tints or dresses are expected to look their best. On the other hand, colour effect is negligible in many factories and workshops, a diffusive and cheap light being of far more importance, and further, there are a number of trades in which the absence of red is a distinct advantage, such, for instance, as photographic process work, where an actinic light is always desirable. Fortunately, however, the colour difficulty where it exists is by no means insurmountable, and the light is capable of improvement in this respect in a very simple manner, at a slight sacrifice of efficiency. As red rays are practically absent, it is necessary to add them, and this can be done effectively by combining an incandescent lamp or lamps—all of which are rich in red rays—in the same fitting as the mercury lamp, mixing or diffusing the two lights by means of a ground-glass globe or shade. On these lines the light may be given the quality it is lacking, to any extent, and although the addition of incandescent lamps naturally reduces the economy, the combination, light for light, must always be more efficient than if glow lamps alone were used. As a matter of fact, a very good effect may be produced, with but a small diminution in efficiency. A 60-watt Bastian mercury vapour lamp combined in the same globe as a 60-watt carbon filament lamp possesses an efficiency of about 0·9 watt per candle, giving light of a colour very superior to that of the mercury lamp alone; and if a 25-watt tantalum lamp be used the efficiency rises to approximately 0·6 watt per candle for the same quality of illumination. Such lamps are in use for street lighting with economical and good diffusive effect, but where a light of a more pronounced reddish tinge is required, fittings similar to that illustrated in fig. 1 are employed. The ground glass or opal shade diffuses the light, and the resulting effect is a soft illumination comparable to daylight, the efficiency of the whole with three 16-C.P. carbon lamps being about 1·4 watts per candle. Using 14-C.P. 25-watt tantalum lamps, the efficiency rises to 0·83 watt per candle. Combined fittings of this class are employed for many purposes where the uncorrected light would be unsuitable. They are installed, for instance, in the Palm House of the Ritz Hotel, Piccadilly, and it is understood that they are giving satisfaction. The extremely high efficiency of the combination and the soft diffusion of its light are points well worth considering, and these qualities might with advantage be put before prospective consumers in cases where a good "working" light at a low cost is an essential.

There is yet another means of correcting the colour of the mercury light, which has met with some success where it is possible to use reflected light only. The lamp, after the manner of the inverted arc, is placed over a conical reflector which throws the light upwards. The inside of the reflector

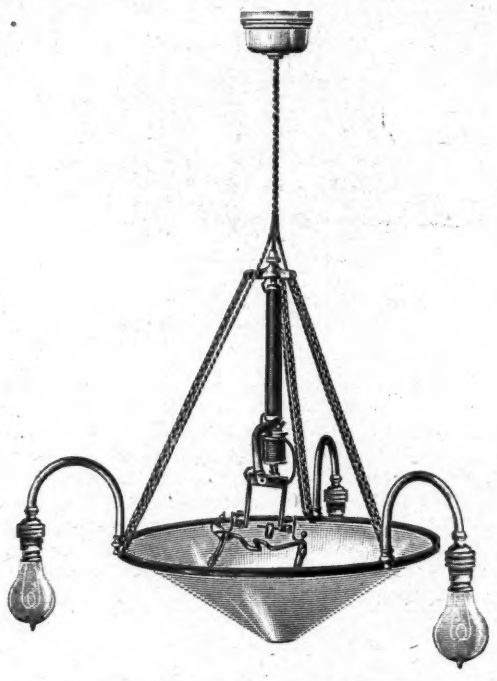


FIG. 1.—BASTIAN COMBINATION FITTING.

is painted with rhodamine, a fluorescent dye which possesses the property of adding pink rays to any light impinging on it, and the result is that the light reflected from the ceiling is of a better colour, although not comparable with that of the combination fitting above-mentioned. The efficiency is probably higher, and the diffusion is good, but on the whole this arrangement is less likely to meet with approval. The idea is ingenious, and possibly it might be very serviceable in special cases. For instance, rhodamine is extremely cheap, and the whole ceiling of a workshop could be painted with it, simple mercury lamps and reflectors being used. At the present time these two methods appear to provide the only practical means for bettering the quality of the light, and whatever the shortcomings of the latter method, the former will be found very satisfactory.

Turning now to the practical application of the mercury vapour lamp, the sphere in which it may be used with credit is extensive, ranging from such small work as billiard table lighting to the illumination of large factories and open spaces. In America, particularly, there are numerous instances of most satisfactory workshop and goods yard lighting by Cooper-Hewitt mercury vapour lamps, the cost coming out at about one-third that of arc lighting, and from one-sixth to one-eighth that of incandescent lamps. Cheapness, however, is by no means the sole recommendation of the light for these purposes; the fact that it is the most diffusive light known is almost as important. The result of good diffusion is absence of objectionable shadow and penetration of the light into every corner and crevice, and for this reason the mercury vapour lamp, with its large light-emitting area and uniform candle-power in every direction, is unequalled for work of a delicate description. The same qualities stand it in good stead for outdoor lighting. Whatever the state of the atmosphere, the penetrative power of the mercury light is good, and the manner in which it carries through fog or steam is remarkable, so much so as to

have caused it to be largely employed in breweries and other places where a steam-laden atmosphere prevails. The photometry of the lamp is unfortunately surrounded by many difficulties, and there appears to be very little obtainable in the way of definite and inclusive results. It is, however, an ascertained fact that the light is much more uniform than that of the arc or incandescent, spreading evenly over large areas instead of brilliantly illuminating a few feet and leaving more remote surroundings in comparative darkness.

The latest form of Cooper-Hewitt lamp is that illustrated in fig. 2. It is termed the KK type, and gives an illuminat-

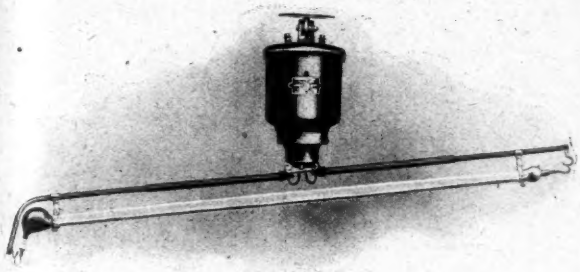


Fig. 2.—Cooper-Hewitt KK Type.

ing effect of 800 c.p. Unlike the older forms, which required tilting by hand to effect the formation of the arc, this type is self-starting directly the switch is closed, the tilting mechanism and line resistance being contained in the case. A smaller lamp, the HH type, gives 300 c.p., and is started in the same manner. For highest efficiency the latter must be run four in series on a 200-volt circuit, and in proportion for other pressures; the K type, however, is designed for running direct on 100 volts. In cases where only one lamp is desired, it is necessary to absorb the superfluous pressure in resistance; although this is, of course, best avoided, it

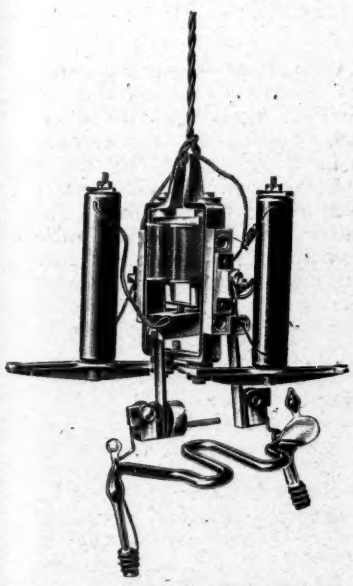


Fig. 3.—Mechanism of Bastian Lamp.

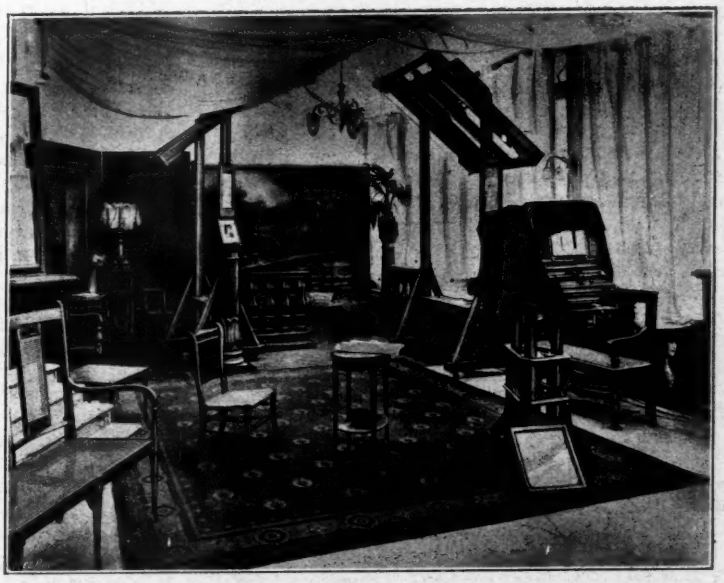


Fig. 4.—Photographic Studio Lighted with Mercury Vapour Lamps.

still leaves the lamp a very good margin of economy over ordinary incandescent lighting. Like all mercury vapour lamps, the Cooper-Hewitt is only suitable for use on a direct-current circuit; so far it has been found impossible to maintain the mercury arc with alternating current, and, unfortunately, there does not seem much likelihood of this being accomplished.

Returning to the Bastian lamp, which is of smaller size, and therefore specially suitable for situations where lighting by a number of low power units is desired, one form of the mechanism and its arrangement is clearly shown in fig. 3. The tube is made either in the S shape illustrated or in the form of a ring. For use on 100 volts it is 5 in. long, and for 200-250 volts 11 in., with a bore in each case of $\frac{3}{16}$ in. to $\frac{1}{8}$ in. It is made of hard Jena glass, which by its nature allows a considerably higher temperature to be maintained in the arc than would be possible with ordinary lead glass, and therefore permits of a high-voltage lamp being made. The employment of this glass is one of the most valuable features of the Bastian lamp, since it does not blacken appreciably, and enables a phenomenally long life to be secured. It is stated that 3,000 hours' efficient burning may be regarded as a fair average for the performance of the lamp, but this is often exceeded, the longest life so far obtained being 10,600 hours with a lamp that is still burning with practically no diminution in its candle-power. The makers attribute these merits entirely to the use of Jena glass, which is rendered possible by the ingenious method of leading in the wires. The ordinary sealing, such as is found in the incandescent lamp, is useless, since Jena glass has a very different coefficient of expansion to that of lead glass and platinum. The leading-in wires are, therefore, made somewhat in the shape of a pin with its centre flattened out, this part being embedded in the solid glass at the end of the tube, while the head is in close contact with its outside extremity. When the glass and the platinum wire cool after the sealing-in process, the latter contracts, gripping the glass tightly, and thus closing the aperture which would otherwise exist owing to the difference in their expansion coefficients. The two vertical coils on the right and left (fig. 3) are the line resistance, and they and the lamp are in series with the magnet coils in the centre. When current is switched on, the magnet attracts a keeper attached to the tube holder, which thus tilts the lamp and starts the arc. Extremely wide variations of pressure have little effect upon the burning of these lamps. For instance, a 220-volt lamp is unharmed by the application of 300 volts, the reason being that the Jena glass will withstand even the high temperature attained at this pressure. In the converse manner, a 220-volt lamp gives a stable light even when the pressure drops as low as 160 volts; the candle-power, of course, decreases, but only in direct ratio with the pressure.

A branch of electricity supply to which central station engineers would do well to pay particular attention is that of photography and its allied trades. By the aid of the mercury vapour lamp much can be done in this direction, as, besides being cheaper to run than either arc lamps or gas, its actinic and highly diffusive light is unequalled by any other artificial illuminant for photographic purposes. There is no question on this point, and photographers, photo-engravers and the like may be approached with full confidence that the mercury lamp will give them satisfac-

tion. Special apparatus is made for this purpose, and fig. 4 illustrates a photographer's studio fitted with two Cooper-Hewitt mercury vapour lamp "skylights." The economy of these fittings over the arc is very great, and at the same time the light is more suitable, being powerful and yet soft enough not to affect the expression of the sitter. In the making of lantern slides and bromide enlargements, it possesses the advantage of not requiring condensers, as it has been found that a uniformly illuminated field of fixed intensity is easily procurable by interposing a sheet of ground or opal glass between the negative and the tubes. It facilitates and cheapens blue printing, taking only half the time that is necessary where arc lamps are employed, and results in deeper and more even prints at a considerably reduced cost for energy. The same advantages obtain in photo-engraving, and for this purpose the current consumption works out approximately at one-third of that of a highly efficient enclosed arc, and one-seventh of that of an open arc.

There are numerous lesser but at the same time important fields for the mercury lamp. Drawing-office lighting, for instance, cannot be carried out as satisfactorily by any other illuminant; the diffusion of the light, and its restfulness for the eye owing to the absence of red rays, tell strongly in its favour. The lighting of billiard tables has been previously mentioned, and although this is a small thing, it affords an excellent example of the class of work in which the lamp shows up best. With six Bastian 120-watt combined fittings installed, the lighting of the cloth is absolutely uniform, and very much better and more economical than that of the usual arrangement of incandescent lamp clusters. This lamp is also used most successfully for colour matching, the addition of the carbon-filament red rays making the comparison of colour values easy and certain.

Perhaps the most striking use to which the mercury vapour lamp can be put is that of advertising. Its unusual colour attracts attention in a way unequalled by any other electric sign, and the ease with which it may be bent into the form of letters standing out in a continuous stream of bright light is an additional point in its favour. The majority of companies and corporations now supply electricity for sign lighting at reduced rates, and in view of this and the popularity of the ordinary electric sign—hackneyed though it be—it should pay manufacturers, contractors, and supply authorities to push the mercury lamp for advertising more than they have done in the past. The backwardness that at present exists is due chiefly to manufacturers' not having exploited the lamp in this direction; but there is undoubtedly scope, as the economy and the quality of the light are both unequalled for advertising. A good instance of its effectiveness is afforded by the *Tribune* offices, outside which six Cooper-Hewitt lamps in special tilting lanterns have been installed. The Bastian lamp also lends itself well to advertising, particularly of that class where a screen is illuminated by lamps alternately switched on and off. It is necessary to install special switching gear for this purpose where glow lamps are used, but with the Bastian lamp, insufficient steadying resistance is all that is required to cause the light to go in and out automatically, and the frequency may be adjusted within wide limits by variation of the resistance. This feature of the lamp is apparently little known, but it is one that might be taken advantage of with profit. In conclusion may be mentioned the latest type of mercury vapour lamp, shortly to be put on the market by the Bastian Mercury Vapour Lamp Co. It is intended for high candle-power lighting, and is large in bore, like the Cooper-Hewitt, but of a horse-shoe instead of a straight shape. The arc is started by tilting, two streams of mercury flowing from the ends of the tube and meeting at the centre of the bend. Full particulars of this lamp are not yet available, but the writer understands that it embodies some special and novel features which should be of interest to those who recognise the great possibilities latent in the mercury vapour lamp.

[See our "Notes" columns for particulars of this lamp. —Eds.]

Electrical Exhibition at Colchester.—The Colchester Corporation is going to run an electrical exhibition for a week commencing October 20th, and intending exhibitors will find a notice on the matter among our advertisements to-day.

LIGHTNING CONDUCTORS.

By FRANK BROADBENT, M.I.E.E.

Now that our long-overdue summer has shown some signs of returning life, its characteristic features appear to be much the same as those to which we have become accustomed, and the expression "three fine days and a thunderstorm" may still be used as a fairly accurate summary of its nature.

A short time ago a paper was read by Mr. Alfred Hands on the *so-called* Vagaries of Lightning, in which he endeavoured to show that the term "Vagaries" was a misnomer, and that all the effects of lightning are such as might be naturally expected from the known laws of electrical action; and he performed many pretty experiments in proof of his views.

The fact remains, however, that lightning does produce many unexpected results, although such results may be explained in a perfectly logical manner, after the event. Whilst, moreover, the action of lightning may possibly be subject to the recognised laws of the electric current, it should not be overlooked that the lightning flash deals with voltages and powers which we cannot together reproduce experimentally, and that the ordinary methods of conducting currents, and insulating conductors, cannot be held to apply.

The daily papers of July 23rd contained many accounts of what are usually termed the vagaries of lightning. Thus, we read:—

"At Camel's Head, Devonport, a thunderbolt struck a telegraph post, bursting about 20 ft. from the ground, enveloping the pole with sheets of fire and stripping off large pieces."

Again, we read:—

"A candle in a metal candle-stick was cut in two by lightning, a similar mishap befalling a tumbler in a bedroom immediately beneath."

In another account we read:—

"St. Catherine's Church, Gloucester, was struck by lightning, the upper portion being entirely destroyed," and at Stroud "an ornamental tower over a wine and spirit store was struck and set on fire."

In another place the lightning, we are told, "tore up railings and knocked down masonry," and at Burlesdon "a green oak tree was struck by a ball of fire and split to the roots."

At Cowes "a thunderbolt fell into the sea with a crash resembling the rattle of artillery."

It is curious to note also how the old notion survives that lightning has some connection with the powers of darkness. Thus, we read, that when the Congregational Church at Lutherworth was struck by lightning during service, the smell of sulphur was for some minutes well nigh overpowering. The feelings of the members of the congregation may be conjectured when we learn that a few words from the minister had the effect of allaying the alarm.

One of the most noticeable features in the accounts of thunderstorms, is that the buildings most often struck and damaged by lightning are those which are provided with lightning conductors. The prevalent idea in the lay mind is that lightning conductors exist for the purpose of attracting the lightning and of providing for it a safe path to earth, thus protecting the surrounding neighbourhood. Now the perfect lightning conductor, if it properly performed its functions, ought never to be struck by a direct flash of lightning. Everyone who is familiar with the ordinary electrostatic machine knows that sharp points produce leakage and prevent the retention of a charge. It would, for this reason, be impossible to fully charge up an ordinary Leyden jar if it were provided with a sharp point instead of a knob. For the same reason it is safer to approach a sharp point connected to a charged electrostatic machine than to approach a blunt point or knob, as in the one case we should get a stream of tiny sparks of a practically harmless character, whereas, in the other case, we should most probably receive a severe shock. Regarding the earth, therefore, as a large Leyden jar, which from some reason or other tends to become charged, it is clear that if a tall mast be erected, making at its base a very good earth con-

tact, and terminating at the top with a very fine point, this mast would form an electrical leakage path from the earth to the oppositely charged clouds; and that the potential near the mast should never rise to such a value as to cause a dangerous flash.

When a building is provided with a lightning conductor, no matter how erected, it is the popular belief that such a building is, or should be, immune from accident due to lightning; whereas, if the earth contact is bad, or if the top of the conductor terminate in a large compact mass of metal, or if the conductor take a tortuous path, the building is probably in a more unsafe condition than it would be without such a conductor. Even supposing a building be provided with a perfect conductor, that is to say, as perfect as human ingenuity can make it, there is still considerable risk of damage in the event of the conductor being struck, say by a side flash, if masses of metal, such as water tanks, lead roof, gas or water pipes, are in the vicinity of the conductor, and are not properly earthed; for, in the event of a lightning flash striking or leaving the conductor, a side flash from the conductor may strike such metal and take a path through the masonry, so doing considerable damage.

Anyone who has worked with high potential high frequency currents knows that there is a something which is akin to inertia, a something which tends to keep the current in a straight path. The effect is to make the current flash through a considerable air space rather than take a path of infinitely less resistance which may consist of a loop or kink of copper tape or rod. This characteristic no doubt accounts for much damage that has occurred to "protected" buildings. A conductor may have a many-pronged finial, and may make good "earth," but a pretty bend round a coping or ledge is a vice which counteracts all its virtues, and a lightning flash will prefer to pass through several inches of masonry rather than take what might seem the easier copper path round it.

It is opportune that these points should be brought to mind at this season. It might be suggested that all lightning conductors should be tested for "earth," and that all metal work, such as gutter spouts, down spouts, railings, piping, &c., should be metallically connected, and "earthed" quite independently of the lighting conductor; that the lightning conductor should be free from sharp bends or kinks, and that its path to earth should be as straight and direct as possible. If it can be erected near to, but quite separate from, the building, so much the better for the building.

CORRESPONDENCE.

Letters received by us after **5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

M.E.A. Convention.

Mr. Vignoles's letter in your issue of to-day refers to my paper of 1904, and the use therein of Mr. Arthur Wright's construction for finding the law of costs of a supply station.

I would be glad to say, through your paper, that I have, for a long time past, recognised that this method, though extremely useful in those early days, and very ingenious, is now not an adequate guide to what I have termed the true running cost.

At the Sheffield Convention I was almost tempted to enter the field in discussing Mr. Burnett's paper, and am again now; but this is a large question, and cannot be dealt with in a single letter.

One thing is clear to me—that the divergence between the "true running cost," of a station of the size of Barrow, as estimated by Mr. Burnett and by myself,* is too considerable for both of these methods to be right.

As regards the maximum demand system, the clauses in my recent paper headed "Combined Diversity Factor," and "Diversity Improvement Factor," were a first attempt to attach a definite numerical value to the preference which should be given to the load which best adjusted itself to the peaks that already existed when this load was introduced to the station. Such a statement of the case takes account of the possible shifting of existing peaks by the over-development of some particular class of load, and would meet the difficulty caused by the application of "restricted-hour" charges, as at present understood, tending to create a new peak. In abandoning the maximum demand method, I would not like to go so far as to say I abandoned the maximum demand principle, for Mr. Wright very early took account of diversity factor.

It is in the form of statement of the charge to the consumer that the maximum demand system seems so wanting.

I beg to differ from your statement that "The stand-by losses of modern power supply are not materially greater during the period of lighter sales." Presumably you mean losses per unit, and not total losses. If, however, fig. 1 of my recent paper is correct, these losses are in most stations materially greater, and will be for some years to come.

I also urge that stand-by losses be not included under running charges.

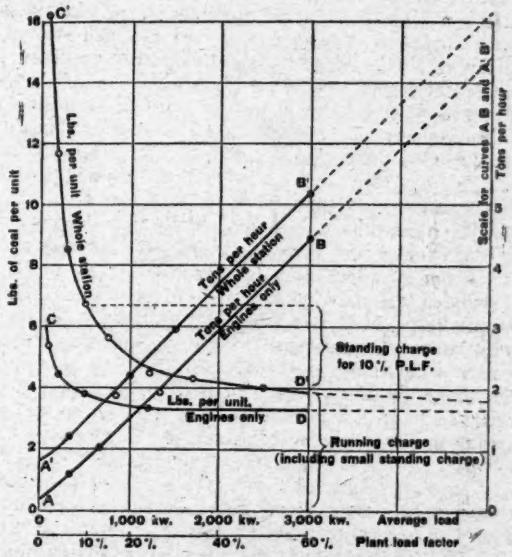


FIG. 1.—COAL DIAGRAM FOR STATION ("CENTRAL STATION SUPPLY ECONOMICS").

With regard to your last paragraph, my recent paper was an attempt "to establish (the outworks of) a definite system for accurately separating running and standing charges," but the more one goes into this question, the more difficult it becomes to deal with it comprehensively.

If, however, we could all agree about *coal* costs, it would be something gained, and I cannot see why the steam consumption test of a representative engine, taken at its most economical load, and translated into pounds of coal in terms of the boiler full-load evaporation test (*i.e.*, ignoring losses in the direct steam pipe to engine, which can easily be estimated separately), cannot be safely taken as a first approximation to the running charge for coal for the station, including, as it does, the full standby loss of both engine and boiler, which is *not* strictly a "running charge," and which will about compensate for the neglected loss in the straight-through pipe joining engine and boiler.

To this result is added a percentage for auxiliaries (full load tests), and, finally, any correction desired may be made for non-compliance with test conditions in every-day working; *not* as regards loading of the set, but as regards *conditions* only. The "running charge" for coal, thus deduced, corresponds with the ordinate of my curve C D herewith, for 5,000 KW., which represents the consumption with every engine and boiler in the station fully loaded, including auxiliaries, and includes losses in straight-through steam connections.

The difference between curves $C^1 D^1$ and C D represents standing losses in steam ranges (per unit generated), and increment of loss *per unit* in engines, straight-through pipes boilers and auxiliaries, over and above that for full-load con

* See my recent paper, "Central Station Supply Economics."—*Journal I.E.E.*, Vol. 39.

ditions; the standing losses, at *full* load, for the latter being included in the ordinates of the curve C D as already explained.

It may be added that the early part of curve C D, covering the range of the out-put of the first 1,000-KW. engine and boiler, is calculated from the engine performance at various loads, whilst the earlier part of C^1D^1 can be obtained experimentally.

I assume that the boiler has a performance curve connecting total coal with total steam, not very dissimilar to that connecting total steam with H.P.-hours in the engine, *i.e.*, that there is a standing loss which is sensibly constant at all loads, as I endeavoured to show in my 1904 paper.

I also assume that most engineers agree that the steam consumption (per unit) of the engine debitable to the running charge is *less* than the observed results of tests made at the most economical loads, paradoxical as this may seem. Similarly with the boiler evaporation.

A. M. Taylor.

King's Heath, *August* 16*th*, 1907.

Telephone v. Trolley: Liability for Compensation.

With reference to "Orient's" inquiry in your "Legal Query" column (August 9th, 1907), assuming there is nothing in the tramway licence providing for the tramway undertakers "guarding" the trolley wires, or *vice-versa*, in the licence of "Orient's" friends, I think the question of negligence hangs on the following points:—

1. The time the telephone wire had been erected.
2. The time which elapsed between the last examination and the accident.
3. The difference in gauge from first being erected to the day of the accident.

I have an idea that a similar accident happened in Leeds a few months ago, and probably if "Orient" writes to the tramway engineer to the Leeds Corporation he could obtain full information. The Board of Trade, as you are aware, now issue regulations on "Guard Wires for Electric Tramways," and a reference to any Act authorising a particular tramway will show how far the undertakers are called upon to protect their wires.

John H. M. Wakefield.

Beckenham, *August* 19*th*, 1907.

Prospects of Electrical Engineering in Canada.

Can you, or any of your readers, inform me through your "Correspondence" columns, what is the approximate cost of living in Canadian towns such as Montreal, Winnipeg, Ottawa, &c.? First-hand information as to the state and prospects of electrical engineering in these towns would also be of general interest and value.

Canadian.

August 16*th*, 1907.

"Sparkless Gem."—A correspondent asks the name of makers of these dynamo brushes.

STEAM, GAS, AND ELECTRICAL BREAKDOWNS IN 1906.

The annual report of Mr. Michael Longridge, M.Inst.C.E., chief engineer of the British Engine, Boiler, and Electrical Insurance Co., Ltd., has come to hand, and we give below a brief *résumé* of its main features.

The rate of breakdowns amongst steam engines last year was unusually high—1 in 8·1 of those insured; for gas and oil engines the rate was lower, 1 in 12·4. The parts most subject to breakdown are as follows:—Steam engines: Valves and valve gear, 23·3 per cent.; spur gearing, 12·0 per cent; air-pump motions, 9·9 per cent.; air-pump buckets and valves, 6·9 per cent.; columns, bedplates, &c, 8·6 per cent.; cylinders, valve chests and covers, 6·1 per cent.; main shafts, 5·2 per cent.; pistons, with rings and bolts, 3·4 per cent.; connecting rods, with straps and bolts, 5·6 per cent. No other item exceeded 3 per cent. Gas and oil engines: Valves and valve gear, 28·7 per cent.; cylinders and cylinder ends, 16·7 per cent.; pistons, 6·5 per cent.; connecting rods and bolts, 12·0 per cent.; main shafts, 15·7 per cent.; governors and governor gear, 7·4 per cent.; fly-wheels and driving drums, 4·6 per cent. No other item was over 3 per cent. The figures do not greatly differ from the results of previous years, though gas-engine shafts during 1905 and 1906 showed a marked increase over the average number of failures (4·5 per cent.), and governor gear was also higher.

From one-fourth to one-third of the accidents were due to unknown causes; of the remainder, in the case of steam engines, one-half were due to wear and tear, and in the case of gas engines about one-third, the remainder being ascribed to defective design or construction, or to negligence. Some examples of steam-engine breakdowns point the moral that special mechanism should be provided for closing the stop-valve from a position of safety. Other examples emphasise Mr. Longridge's repeated warning regarding the dangerous effects of a sharp corner instead of a rounded fillet at a change of section in a shaft—an elementary piece of advice, indeed, but amply justified by the constant recurrence of failures due to this cause.

An important loophole for disaster to enter is exemplified by the case of a motor-driven jet-condensing plant, which on two occasions was shut down before the engine connected with the condenser had come to rest, the result being cylinders filled with water and wrecked.

Dealing with gas engine breakdowns, Mr. Longridge states that every frost brings a number of claims for broken cylinders due to the jackets being left full of water. The author gives an approximate formula for the best modern practice in designing crank shafts. Where C is the cylinder diameter, D and d the diameters of the crank pin and shaft journals respectively, l the distance between the inner ends of the bearings on each side of the crank, and r is the length of the crank arm, all in inches, for engines with cylinders up to 12 in. in diameter $C^2 (l + d) \div D^3 = 10$ to 11, and for engines with 20-in. cylinders = 15. Similarly $C^2 r \div d^3 = 10$ to 11, rising to 13 in large engines. The author points out the heavy tensile stresses which have to be borne by gas-engine connecting rods and bolts, not only due to the inertia and friction of the piston on starting the suction stroke (four-cycle type), but also to the bending action caused by centrifugal force at the big end. He suggests a forked end with cotters, instead of the usual marine type. The danger of drawing air through the box bed of a gas engine is referred to in connection with an explosion due to leakage of gas, resulting in the wrecking of the frame; and the necessity of periodically cleaning out the deposit from cylinder jackets is similarly driven home, neglect of this leading to cracked cylinders.

A considerable increase took place in the number of dynamos and motors insured, but the breakdowns on such increased in a lower ratio. A very large number of starting resistances have also been insured, but in this case the breakdowns have increased far more rapidly. The failures of dynamos numbered 1 in 16 of those insured, and of motors 1 in 8·2. The rate amongst D.C. machines of both kinds was twice as high as amongst A.C. machines, but the cost of repair per breakdown was only about one-half, doubtless due to the relatively large sizes of A.C. machines. The proportions in which the various parts of the machines contributed to the total are shown below:—

Part supposed to have failed first.		Dynamos.	Motors.
Armatures and rotors	per cent.	50	44
Magnet coils and starters ...	,,	11	14
Commutators and brush gear ...	,,	20	28
Miscellaneous	,,	19	14
		Starting switches and controllers.	
Resistance coils	per cent.	48	
Contacts and switch arms	,,	10	
Automatic apparatus...	,,	17	
Miscellaneous	,,	25	

The causes of the breakdowns are summed up as follows:—

		Dynamos.	Motors.	Starters.
Accidental	per cent.	15	9	22
Dirt and neglect ...	,,	14	19	11
Age and deterioration	,,	21	25	23
Bad workmanship and design	,,	23	18	9
Overloading... ...	,,	0	2	7
Unascertained ...	,,	27	27	28

The examples of breakdowns cited are hardly so interesting as usual. The liability of the insulating washers in commutator ends to become greasy and dirty is pointed out, and last year's reference to the use of "made-up" mica of poor quality is repeated, soft green mica being recommended for small motors.

The company has met with numerous cases of short-circuiting of commutators due to this cause, "particularly among machines of certain makers," and its experience has led to the belief that many foreign-made commutators are sold in this country, not a few of which are of stinted dimensions as regards depth of copper.

Several instances are given of damage due to the loosening of screws by vibration, allowing pole-pieces to come in contact with the armature; the combination of set-screws used for this purpose with lifting eyes is especially apt to cause trouble, as the screw may be twisted by the hook of the crane. In one curious instance it was found that the bottom magnet was loose, and was pulled up against the armature core when the machine was excited, though there was no visible indication of the defect.

The detailed engine test reported this year relates to a Diesel engine of 500 B.H.P., made by Messrs. Sulzer Bros. It had three

single-acting cylinders, and ran at 150 R.P.M. There was a slight uncertainty as to the exact value of the B.H.P. developed, owing to the power being absorbed by a belt-driven dynamo; but on the estimated output the consumption of crude oil (18,000 B TH.U. per lb., equivalent) was 0·449 lb. per B H.P.-hour at full load, 0·484 at half load, and 0·568 at one-quarter load—figures practically identical with the guaranteed values. The mechanical efficiencies of the engine at these loads were 0·755, 0·627 and 0·537 respectively, and the thermal efficiencies were 0·42, 0·47 and 0·468.

THE DANGERS OF CONTACT WITH ELECTRICAL CURRENT.

In a recent issue of the *Chemiker Zeitung*, Herr Hermann Zipp, lecturer at the Municipal Polytechnic at Cöthen, discusses the danger to human life introduced by accidental contact with an electrical current, and comes to the conclusion that the extent of the injury is not entirely due, as is generally imagined to be the case by non-technical people, to the voltage of the current, but partly or mainly depends on the quantity of electricity which is caused to flow through the human body and upon the parts of the system to which it penetrates. The experiments that have been carried out on the physiological influence of electrical currents show that a part of their effect is due to their electro-chemical action upon the liquids of the body, and part to the injury done to the most important organs by contact with the current of electricity. The following facts have indeed already been established:—(1) When a current flows from hand to foot under the worst conditions, that is to say, when a man's boots are thoroughly soaked with water and his hands are damp, the resistance of the human body is on an average 5,000 ohms. (2) When an alternating current of 5 milliamperes with 50 complete alternations per second flows through a person, the effect is sufficiently marked to produce muscular contraction; hence in the author's opinion a current of from 50 to 100 milliamperes must be undoubtedly considered as dangerous to life provided it comes into the neighbourhood of the most important organs of the body. In judging of the degree of danger exhibited by any electrical installation, therefore, the investigator has to inquire whether it is possible that a current of such volume can be introduced into the human system from any part of the plant. The chief sources of danger are, of course, a broken conductor, too highly charged a conductor, and the effect of lightning; but the following points have also to be borne in mind, viz., bad insulation or high capacity in items of the plant, and the conversion in a transformer of a high tension current into one of low voltage.

The author accordingly proceeds to discuss the various accidents that have arisen, or are liable to arise, under four separate headings. (1) Simultaneous contact with both conductors. (2) Contact with only one conductor. (3) Contact with the "charging current" in alternating installations; and (4) Dangers introduced during the reduction in voltage of a current.

1. *Simultaneous Contact with both Conductors.*—In certain conditions, *e.g.*, a chemical factory or a mine where the atmosphere, &c., is damp a man may be injured by contact with a 110-volt current; because his personal resistance, being lowered to 5,000 ohms, as already stated, he may receive a current of 25 milliamperes therefrom. It is even possible in some cases, where the air is loaded with acid vapours, that the conductivity of the human skin may be greater still, so that death may be caused by contact with a current of 110 volts. In practice, however, this circumstance does not involve great risk, because it is more easy to eliminate the dangers attendant upon an electrical plant than those of any other form of machinery. In the reports covering the year 1905 issued by the Prussian "Regierungs und Gewerberäte und Bergbehörden" (Factory and Mining Inspectors), seven fatal cases and two severe accidents caused by electrical currents were mentioned. Two of the fatal cases were due to wilful carelessness; the third was caused by a workman interfering with a transformer; the fourth to a man unnecessarily passing between a switchboard and a high-tension transformer; the fifth to a man accidentally making contact between the metal cage of a hand lamp running with an alternating current of 110 volts and a water main, the insulation of the lamp having become defective. (This accident will be referred to again later on.) In the sixth case a man slipped when he was erecting a conductor to convey a 130-volt alternating current, and made contact between it and the end of a wire lying on the ground. In the seventh case a man was killed with a 500-volt current. In one of the non-fatal cases a man touched the collector of a 120-volt machine with damp hands, and was rendered speechless for three weeks. The reports of the Prussian mining officials for the year 1905 contain accounts of ten fatal accidents in connection with electrical plants, several of which were due to gross carelessness or want of foresight. In every case where death resulted it was shown that the damp air in the workings underground was a very important factor in the case, lowering the resistance of the human body so much that a current of 220 volts was sufficient to produce death. A very curious accident occurred some years ago in the town of Cöthen. The owner of a bathing establishment, who knew little of electricity, had the idea of installing an electrical bath. He fitted up a pair of electrodes at the two ends of a slipper bath, connected them with the 120-volt alternating circuit of a neighbouring supply, and tested the effect upon himself. At the moment of entering the bath he received a shock from head to foot, and, owing to the resistance of his body being lowered by contact with the water, the effect was instantaneous death.

In a large number of cases simultaneous contact with the two wires of a circuit produces no effect at all, either because the man's skin is dry, and so forms an excellent insulator, or because the current passes without coming near any critical organ. For example, some time ago the writer himself accidentally placed one hand between the two contact pieces of a 1,000-volt transformer in such conditions that the current passed for a distance of about 2 in. through his flesh. The effect was a severe shock to the system and a momentary combustion of the skin, but no further ill effects followed. If, however, the contact had been made with both hands, a current equal to 100 milliamperes would have passed through his system even if his resistance had been as high as 10,000 ohms, and death would have certainly resulted. It is, therefore, clear that arrangements should always be made to prevent the possibility of simultaneous contact with both conductors of a circuit, either by compelling the men to wear rubber shoes and gloves, or preferably, the complete suit of clothing designed by Prof. Artemieff. This consists of a garment woven out of stout linen with a layer of fine copper wire, and is so formed as to enclose the whole body. If a man wearing this clothing makes contact with both high-tension conductors, the current passes *vid* the copper wire, and practically none enters his system.*

Special care is required in using portable electrical apparatus, such as hand lamps and motors, when the atmosphere is damp. It is always possible that the insulation of such appliances, especially the boring tools used in mines, may become injured, so that the casing of the motor or the cages of the lamps may receive current—as evidently happened in the fatal case mentioned above. The best method of dealing with such apparatus is to provide the casings and cages with earth wires, but it is necessary to see that the earthing is really effective.

2. *Contact with One Conductor.*—When a man makes personal contact with the two conductors of an electrical circuit simultaneously, nearly always gross carelessness is involved; but it is a much commoner thing for him to touch one of the conductors. Inasmuch as no perfect insulator exists, at every spot where a conductor is supported, some leakage of current to the earth occurs. The amount of leakage at any single insulator is negligibly small, but in a very long circuit, where large numbers of insulators are employed, especially in a damp atmosphere or one charged with acid vapours, the total losses of current are serious. Now, if a man standing on the damp ground touches one of the conductors, a current passes from the wire, through him, to earth, and returns *vid* the numerous insulators of the other conductor; and the greater the number of insulators on the circuit, the more dangerous is the current that enters his body. In this particular case, clearly, it is not the voltage of the current which is of chief importance, but the length of the conductors in the circuit that are supported on insulators. The case mentioned above where a man received a fatal shock by contact with the wire cage of a glow lamp, could only have occurred in an extensive electric system, provided, of course, that the wiring had been done properly. The author has intentionally touched the wires of an alternating electrical circuit about 150 ft. long in which the pressure of the current ranged between 3,000 and 5,000 volts. The insulation of the conductors not being defective, he experienced no ill effects; but had the circuit been several hundred feet longer still, some harm would have been done to him. Hence it follows that arrangements should be made preventing the possibility of contact with a single conductor of any electrical plant, even if the pressure is low, except under such conditions as when a man has his hands or feet properly insulated.

3. *Contact with the "Charging Current" in Alternating Installations.*—When the two coatings of a Leyden jar are connected with the poles of an alternator they receive alternately positive and negative charges, and the quantities of electricity necessary to produce these charges must flow through the wires. The quantities of electricity pulsating in the wires under the conditions mentioned, may be termed "charging currents," and are sufficiently large to be indicated by an amperemeter or, if the Leyden jar is large enough, by causing an incandescent lamp to glow. The larger the size of the Leyden jar, *i.e.*, the condenser, the larger are the amounts of electricity stored in it, and the larger is the charging current. Every conductor of electricity forms such a condenser with the earth; and if a man touches one conductor, his body acts as the wire of the condenser, conveying the charging current to earth. The other coating of the condenser is the untouched conductor, and is obviously connected with the source of alternating current. Hence through the body of the man flow the charging currents of the condenser which is formed of the earth and the second conductor; and if the latter is large enough, that is to say, if the conductor is long enough, the charging current may be of sufficient volume to cause death. This charging current is the chief cause of fatal accidents when contact is made with a single high-pressure wire, because the currents due to faults in insulation, which have been previously discussed, are usually far too small in amount to be of importance. In the particular case now under contemplation the length of the distributing system is far more serious than the voltage; and it may, therefore, be said that every high-pressure installation is dangerous when only one conductor is touched, provided a man's hands or feet are not well insulated. Armoured lead cables are especially dangerous, owing to their high capacity, and

* The fact that this garment might become a veritable shirt of Nessus, in the shape of a coat of fire, seems to have been overlooked.—Eds.

contact with them is likely to produce worse results than contact with a naked wire.

From what has already been stated, it is evident that, more particularly in cases where the installations are employed in a moist atmosphere, there is danger, not only in simultaneous contact with both conductors, but also in contact with one. Escape of current is particularly liable to occur from badly built switchboards and similar apparatus, although such escape can easily be prevented by proper construction. It is very necessary that new installations or enlargements to existing plants should only be made under the supervision of men who understand the matter thoroughly.

In this connection it may be of interest to quote some figures from the reports of the German factory and mining inspectors for the year 1904. According to this report between 200,000 and 250,000 accidents occurred throughout the Empire in the year under consideration. Of these about 1,000 accidents were fatal, 16 being due to electrical current, and 28 to machinery shafting, &c. The figures relating to accidents in mines are very interesting, as showing how extremely few cases have been due to electricity. Some of the figures quoted in the Government reports for different years are given in the following table:—

Year.	Electrical current.	Explosions.	Falls of earth, &c.
1899	4	26	394
1900	2	20	403
1901	2	59	431
1902	4	10	391

4. *Dangers of Transformation.*—In this section of his article Herr Zipp briefly refers to the danger experienced by a man who receives a current in the neighbourhood of a transformer. As the insulation of a high-tension circuit is much better than that of a low-tension circuit the current which always tends to escape from the former to earth often finds it easier to pass first to the low-tension circuit, and then to earth. If, now, the resistance between a low-tension circuit and the earth is 20,000 ohms, and a man, the resistance of whose body is 10,000 ohms, approaches that circuit, he may receive a part of the current which is on its way *vid* the low-tension circuit from the high-tension circuit to the earth. The risks, indeed, are practically the same as those when direct contact with a high-tension circuit is made accidentally.

In a final paragraph the author refers to the very high voltages (namely, such as 100,000 volts), which are not dangerous to man when the frequency of the current is very great, reaching, for example, 100,000 alternations per second; and he ascribes the harmlessness of these Tesla currents to their passage along the outer surface of a conductor, so that when the conductor in question is a human being the critical organs of his body are not affected by them.

In a later issue of the *Chemiker Zeitung* Dr. H. Danneel, of Friedrichshagen, criticises certain features of Herr Zipp's article. He takes it for granted that the physiological effect on the human body of an electrical current is due to electrolysis, *i.e.*, to the migration of the ions in the living cells. Hence the only important question is the number of coulombs of current which enter the system, not the number of amperes. He, therefore, regards the harmlessness of Tesla currents as due to the extremely minute quantity of electricity per phase, which causes the alteration in concentration in the cells of the human body to be insignificant. In a brief rejoinder Herr Zipp disputes the accuracy of the purely electrical view propounded by Danneel. As stated in his main article, he attributes much of the effect of an electrical current upon a person to its electro-chemical action, but the influence on the nerve centres—that is to say, the shock produced by the current—must not be neglected; and the magnitude of this shock would appear to be, to some extent, a function of the voltage.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

New Power Fuseboards.

Messrs. Parmiter, Hope & Sugden, of Hulme Electrical Works, Manchester, have lately been busily engaged in bringing out some new specialities in the way of ironclad power distribution boards, to which we now propose to draw our readers' attention.

But perhaps we may be allowed to preface our descriptive notes relating thereto by the remark that we gave the firm an editorial "look in" when up in Manchester a few months ago. They were then in the throes of a removal to their more extensive premises on the other side of the way, and we were pleased to learn during our interview with one of the principals that the firm's enterprise and expenditure in following up new lines in electrical switch and device design and manufacture were being well rewarded by the rapidly growing amount of good business they were doing. After this digression, let us say that the firm have devoted very close attention to the subject of power boards, and the new ironclad distribution fuseboards which are the product of their recent ingenuity and labour, have been designed for heavy motor work, for use under rough conditions, as a central distributing board for motor circuits. Fig. 1 shows a four-way heavy-type power board, 200 amps. per way, of their standard latest pattern, with fuses of their porcelain "C" type, 5½ in. clear break. The particular advantages claimed for these boards are as follow:—The boards are entirely watertight and gastight, this being obtained by using a rubber ring round the lid, and the firm's patent sealing troughs for sealing the cables.

As the illustration shows, there is an exceptional amount of clear space allowed around all the live parts of the case. The insulation of the boards is guaranteed to be at least 5 megohms, and we understand that, as a rule, 50 megohms may be relied upon.

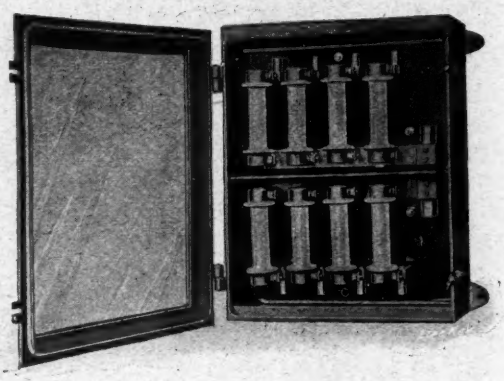


Fig. 1.

The fuses used on these power boards are of their "C" type (fig. 2). As a general rule, bad tests on power installations are due to leakage in the ironclad switches or fuseboards. The makers claim that they have been able, by adopting certain new practices, to practically remove all possibility of leakage. The contacts

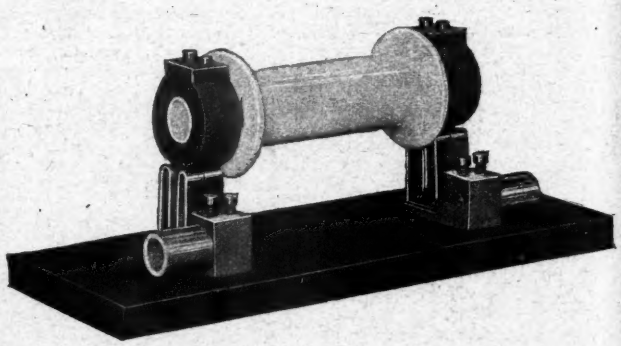


Fig. 2.

consist of phosphor bronze clips built up in solid brass shoes. All the parts are pinned, and none of them can come loose. The metal parts are very massive.

Special attention has been given to the question of wiring these boards, which is generally a difficulty; and they can be erected and connected up with a minimum expenditure of labour. They are

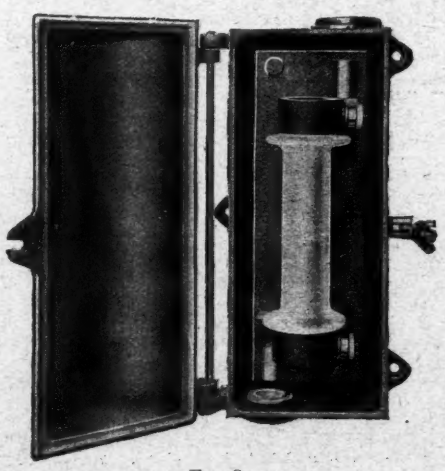


Fig. 3.

all front connected; the slate bases are mounted on insulated pillars, and can be quickly withdrawn from the front of the case. In addition to this, all the sweating sockets are made to clear the entrance holes, so that the cables can be put in after the boards are fixed. The cases are of a special quality of cast-iron, are well fitted, and are entirely watertight.

A special point is made of delivery of these boards. The interiors are stocked complete, and the cases fitted. Messrs. Parmiter, Hope claim that they can deliver a board of any size in three days from receipt of order.

They also make an "A" type power distribution board, which is practically the same as the standard board in general construction, except that the fuses have a less break, and the cases are of rather lighter construction. The same general principles, however, apply to these boards, and the quality and workmanship are exactly the same.

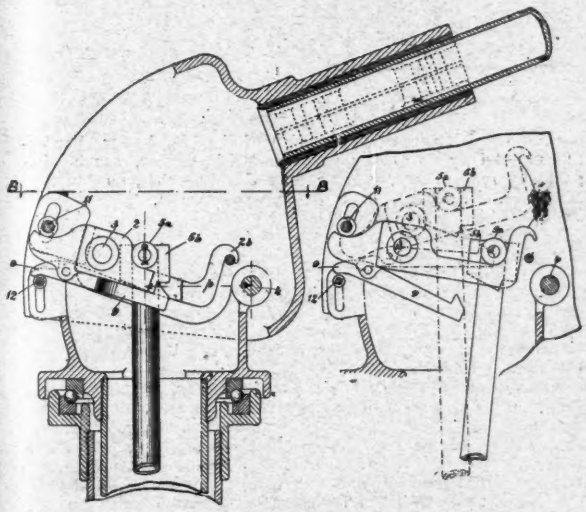
In fig. 3 is illustrated one of their new "C" type ironclad fuses. These consist of a section of power board made up in single-pole cases. The general construction of these ironclad fuses is exactly the same as for the power boards; the fuse handles are interchangeable with them. The fuses which are used for the power boards, and also for the "C" type ironclad fuses, are the firm's "C" porcelain handle type, which are guaranteed to be unbreakable when tested on a dead short circuit, at the maximum rating at 600 volts. The china is of a special quality. The metallic ends are fixed to the china by special cement, which is not affected by heat or moisture.

A New Trolley-Pole Retriever.

The latest thing in devices for drawing down a trolley pole after the wheel has jumped the wire is the invention of Mr. J. H. Collies.

Figs. 4 and 5 show the general arrangement of parts as applied to the standard of an open top-decked car, and the following description will enable our readers to follow the drawings.

Normally the roller 5*a* on the spring head exerts a downward pull upon the shorter arm of the trolley at a fixed distance *p* from the fulcrum 4, the block 5*b*, to which the roller is attached, being locked by the forked detent 9. The pull is not transmitted directly to the shorter arm, but through the secondary lever 2, which is pivoted at 3 to the main arm, and the end of 2 hooks itself on to another fixed point at 2*b*. When the pole rises above a certain height, the tail of the detent strikes the lower stop 12 and is arrested, whereupon the forked end disengages from the spring head block and allows the roller to travel down the inclined secondary arm towards the fulcrum 4. The leverage of the spring being reduced thus, the trolley pole can no longer be held up, and it falls accordingly until the tail of the secondary lever comes into contact with the upper stop 11.



FIGS. 4 AND 5.

Many inventors have reached this point, but few have solved the harder problem how to bring back the spring into action. Mr. Collies manages this in a simple way by pulling the pole down still farther by means of the trolley rope. This forces the tail of the secondary lever against the stop 11, as the end of the main arm of the standard moves around the fulcrum 4 until the roller 5*a* runs down the reversed grade and settles into the first position, in which it is locked again by the detent 9.

This detent is pivoted to the secondary lever, but fig. 2 does not show clearly how it is brought into the horizontal position, and in other details this drawing is defective, chiefly by reason of the difficulty of showing two sets of actions without complicating matters hopelessly.

The specification goes on to describe the application of the invention to the trolley standards of single-decked cars and of double-decked cars with roofs.

The principle of reducing the leverage of the spring is novel and pretty, and we shall be interested to know whether this patent is to be more favourably received than previous attempts to achieve the same end have been.

A New Tool for Shipyards.

It is rather a quaint sight to see in some of the yards in our great shipbuilding centres, which are equipped upon the most strictly up-to-date lines, winches placed about the works and upon ships under construction which are driven by donkey engines supplied by distinctly antiquated-looking boilers. This spectacle, which seems amazing when it is known that in most of our up-to-date shipyards electricity is used as a motive power wherever it is at all possible to do so, is said to be due to the fact that until lately an electrical winch which was entirely impervious to weather and sea water was not on the market. Certain difficulties of construction interposed themselves in the way of the adoption of such apparatus.

The steam-driven winch is notoriously a source of great waste of coal. Steam pressure must always be kept up, whether power is required for lifting or not. There must always be a man in attendance who has, in addition to the duty of controlling the motion of the winch, to stoke the fire, keep the engine oiled, and generally nurse a rather refractory baby-size power generator of an inefficient type. The standby losses on such a plant therefore form an appreciable item in the cost of the work. Added to this, portability is not altogether attained, and any attempt to run steam-pipes from the boiler to the donkey-engine involves a large amount of work and limits the freedom of movement from place to place.

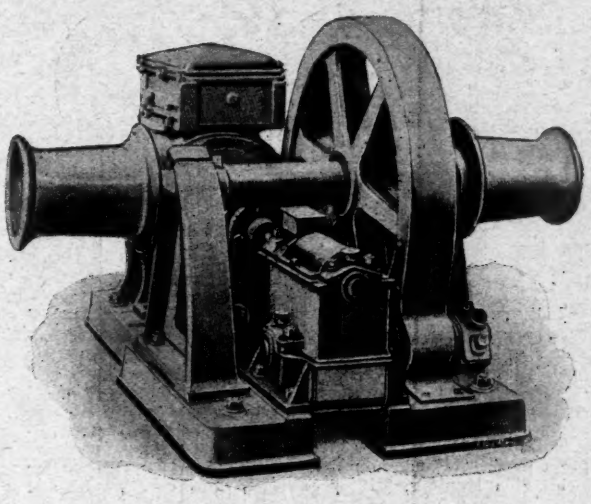


FIG. 6.

MESSRS. JARVIS BROS., LTD., of Middlesbrough, have for some time been engaged in studying this problem, and have produced an electrically-driven winch which in both its electrical and mechanical equipment is completely protected from rain and sea water. The accompanying illustration, fig. 6, gives a general idea of the apparatus. It will be noticed that, in order to secure complete watertightness, the controller resistance is enclosed in the same case as the motor. This is a unique feature which has never before been developed in electric winch design, and is protected. Owing to the large radiating surface of the carcase of the motor, the heat developed by the resistance grids of the controller, which are of the flat grid type, is speedily dissipated, and the motor, contrary to the apprehensions of some who considered that a partial enclosure of the motor and gear was the nearest approach to safety that could be made with a reasonable temperature rise, remains normally cool even when worked continuously on rapid lifts.

An interesting feature is the means taken to avoid damp deposit on the interior of the controller case when the gear is out of commission for some time, a trouble that occurs in any enclosed plant placed in an exposed position. A very small tube is let in through the bottom of the case to a distance of four inches above the bottom. This admits air freely, preventing stagnation, but is too small and long to allow even a heavy sea to wash up into the case. An interesting experiment was tried recently on a winch which is one of six working at the yards of Sir Raylton Dixon & Co., Ltd., of Middlesbrough. A heavy stream of water was directed on to the winch for half-an-hour from a fire hose, thoroughly searching the apparatus. Immediately on the expiration of this drenching the winch was set to work, and continued lifting its loads without any trouble whatever.

The winches are of standard make, to be ordered from stock, and are capable of lifting three tons at a speed of 30 feet per minute. As they are subject to severe stresses in working, every part is liberally designed (although the whole plant is much more compact than any other form of winch) and made of strong and good materials.

The "Marvel" Switch.

The device, which we show in the accompanying illustration (fig. 7), is the latest development introduced by MESSRS. A. P. LUNDBERG & SONS, of Liverpool Road, N., in the direction of branch switches, and they claim that it marks a new departure in such switches for domestic lighting.

The great popularity of the convenient methods of controlling lamps or other apparatus, from two or more positions by means of "pivot" two-way and "pivot intermediate" switches, as used in "two-way" and "intermediate" wiring, has led the firm to develop still further the possibilities of convenient control from two positions, and the "Marvel" switch is the result. The principle of its construction is such that it may be varied in regard to the arrangement of the contacts on the rocking bar, and used for the production of other types of switches. The switch has three positions for the lever knob, all of them very definite. This is accomplished by the improved movement; one spiral controlling spring only is

used, and this allows uniform tension as in the "Duplex" patent movement.

The rocking contact-arm consists of a piece of insulating material, on each side of which are arranged contact studs suitably interconnected, such becoming current-carrying or not, according to the position of the knob and the circuit connections.

The rocking contact-arm is locked in each of the inclined positions of the knob and cannot be released through vibration. All parts are interchangeably produced, the bases are of standard diameter,

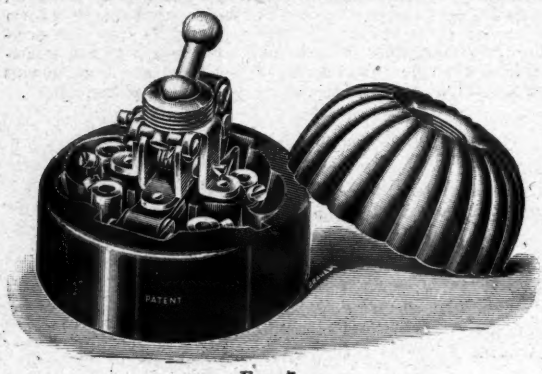


FIG. 7.

and all covers as fitted to the "Pivot," "Presto," and other standard types, are interchangeable with it. Looping-in terminals are provided, and these are well sunk, and with the exception of one application in which lamps are arranged in "series" or "parallel" or turned "off" as desired, from two positions, they are arranged on one pole only. A pattern for flush work has not so far been produced, and the carrying capacity in its present form is two amperes at 200 volts. In a list which the firm has just issued are given particulars and diagrams of a number of applications for lighting in hospitals, railway carriages, ships' cabins, hotel and other bedrooms, &c.

Draught Indicator.

A few weeks ago a correspondent asked for the name of the maker of the "Evertrusty" draught indicator. This is supplied by MESSRS. WALLACH BROS., of Royal London House, Finsbury Square, E.C., and is shown in the illustration (fig. 8) herewith. By the aid of this instrument the exact draught pressure in boilers, &c., flues, can be determined at a glance, and thereby a constant minimum pressure be maintained. In the case of the "Evertrusty" type gauge, the internal arrangement is based on a simple inclined plane or blade system, coming directly in contact with the pointer on the dial of the gauge, which is graduated in $\frac{1}{100}$th parts of an inch. The draught in the flue, entering the gauge through an opening arranged at the back, passes upwards and comes in contact with the underside of the accurately balanced

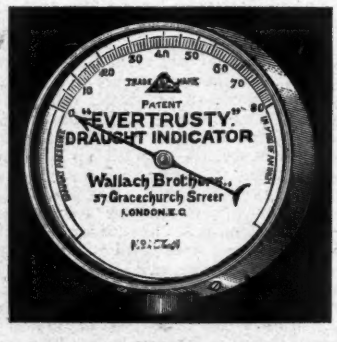


FIG. 8.

blade, and, by lifting same in accordance with the amount of pressure exerted, raises the pointer to a corresponding registration on the dial of the gauge. The great attraction in this pattern lies in its extreme simplicity, and its accuracy is sufficient for all practical purposes. The patent draught gauge for boiler flues, 1901 type, is a more expensive attachment, and is specially recommended where extreme accuracy is essential. Briefly, the instrument consists of a bell-jar, the mouth of which dips into petroleum. A pipe passing under the mouth of the bell-jar connects the air space inside it to the boiler flue or chimney, and the bell is counter-poised and swings about a knife-edge. The slighest decrease of pressure in the boiler flue is communicated to the bell-jar, which consequently tends to dip more deeply into the liquid, and its motion about the knife-edge is transmitted to the pointer of the gauge.

Workshop Cranes.

From PAUL WEYERMANN G.m.b.H., Knesebeckstrasse Rixdorf, Berlin, we have received catalogues in German of hoisting and lifting apparatus of every description, of which the firm makes a specialty. The general list also contains particulars of overhead travellers, both mechanically and electrically operated.

A smaller list contains particulars of lifting apparatus for workshop use, including a very useful hand crane, which we illustrate (fig. 9.), and which can be moved from place to place as required;

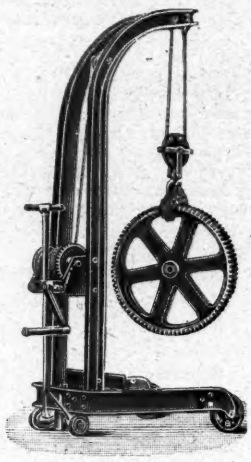


FIG. 9.

by a clever arrangement of the drawbar, which throws one pair of trolley wheels out of action, the risk of moving, when raising or lowering, is eliminated.

The list is also issued in French, and an English catalogue is in preparation.

LEGAL.

A MANCHESTER CLAIM.

A DISPUTE arising out of the erection of the Manchester Corporation's electricity works in Stuart Street, Manchester, was investigated by Judge Parry, at Manchester County Court, on Monday. Mr. Wm. R. Tench, engineer and contractor, of Old Hall Road, Withington, sought to recover £50 which he alleged he had lent to Mr. R. Holway, of Cricklewood, between 1901 and 1905, while he was sub-contractor at the electrical works, where defendant was acting as clerk of works.

Defendant denied the debt, but admitted receiving £20, which he declared was in payment of services rendered to plaintiff's son, who was one of the fifteen sub-contractors at the works, and who, he alleged, had not sufficient experience to enable him properly to carry out certain works.

After evidence had been given on both sides, his HONOUR said it had revealed a state of affairs which, if discovered nowadays, would lead to a criminal court investigation. Mr. Tench was apparently in such a position that, without doing anything dishonest, he must keep on good terms with the clerk of works. The suggestion that defendant should be paid for what he said he had done for the plaintiff's son indicated what kind of man he was. From time to time he had pestered Mr. Tench for loans of money, knowing very well what a difficult position the plaintiff was in. No man of that type ought to be entrusted with the duties of a clerk of works. It was a matter, his Honour continued, which ought certainly to have been taken before the contractor or the Corporation, and have resulted in the defendant's dismissal. Even in the bad old days when it was, more or less, a custom of the trade, the plaintiff ought not to have submitted to this, for after the first loan or two he ought to have seen the character of defendant. Fortunately, there was nowadays no excuse for anyone falling into such a position. As some of the transactions were probably loans, he gave judgment for plaintiff for £34 and costs.

TRAMCAR NUISANCE CHARGE.

ACCORDING to a Birmingham paper, the General Electric Tramway Co., Ltd., were summoned at West Hartlepool for causing an annoyance by using four cars that clattered. Mr. Matthew Harrison, who defended, asked the town clerk to agree to an adjournment to enable the company to put the cars right. The town clerk consented, but suggested that the cars should be taken off the line altogether, and that the whole stock should be lubricated twice daily, instead of once. Mr. Harrison promised to convey the suggestions to the company.

Roller Bearings.—It is reported that over 600 roller-bearing axle-boxes of the Empire type have been supplied for use on the Rio tramways.

REVIEWS.

Agglutinants of all Kinds for all Purposes. By H. C. Standage. London : Archibald Constable & Co. 1907. Price 6s. net.

This is a remarkable book, for the author seems to have set out with the idea of the old makers of museums : he gathers everything, wherever found, and puts it into his collection. The result is remarkable and somewhat annoying, as it is very difficult to find the grains of wheat among the chaff.

Some of the recipes are absolutely irrational, and being interesting only as survivals from a pre-scientific age, have no business in what professes to be a work intended for practical people in the twentieth century. A good instance of this is found on page 5, where "2 oz. of fish isinglass in powder" is directed to be mixed into a composition, the remainder of which is copal or other resin, turpentine, and spirit of turpentine, with iron filings and rottenstone. The mind of the more or less medieval inventor of this nostrum is apparent : he knew that a cement could be made of isinglass, so he ascribed "cementitious functions" to it ; hence it was a proper constituent for a cement that depended for its properties on substances which, so far as they are fluid, are non-miscible with water. He did not know that isinglass did not dissolve in spirit of turpentine ; but Mr. Standage does, or ought to know, and we think that he performs a very ill service in putting forward such recipes without a word of comment. This is described as a cement for marble. Why ? Is it not suitable for serpentine, granite, or slate ? and if not, why not ?

Again, we scarcely think that Mr. Standage has considered the following, on page 6 :—"Mix 4 lb. brown amber, 1 lb. linseed oil, boil for two hours and then stir in 2 oz. beeswax, 5½ lb. chalk, and 11 lb. white lead ; mix well." This is described as a putty. Granted the proportions are correct, surely it should have been pointed out that such a mixture requires some sort of mechanism to produce it with anything like evenness in quality.

On the next page we are informed that a paste requires enough hot water to "cook the flour (that is, cause the separation of the gluten"). We always supposed that the "cooking" in question depended on the bursting and gelatinisation of the starch granules, but we live and learn. Chemists will note this entirely novel way of separating gluten from flours with interest.

On page 9 we come upon a remarkable putty for water pipes consisting of "10 parts rosin, 10 parts cotton wool, 10 parts of calcined lime ('quick lime'), 3 parts linseed oil varnish." We reproduce this without comment—it goes beyond us. On page 37 a cement appears as of profound political import. We find, recipe 116, "Cement for Architectural Purposes ; " "mix 1 lb. alum, powdered, with 5 lb. slaked lime and make into a paste with 37½ oz. of beaten bullock's blood. This 'blood' cement is no doubt what has raised suspicion in the mind of the natives of India and other countries that the blood of young children is used in building by the Christians." This is a new light on the cause of the troubles which sometimes arise between Eastern and Western races, and we commend it to the notice of Mr. John Morley, who had better issue an order forbidding the use of this "Architectural Cement" in India before further difficulties arise.

Engineers will meanwhile be interested to know that the author has (page 155) made a protective coating for rivets. They are to be dipped into a bath of "melted sulphur to which 1 or 2 per cent. of *tallow gas* has been added," but, unfortunately, he omits to tell us how to make the "tallow gas," or how to mix it with the melted sulphur when made. On page 227 chemists will find the question of the setting of plaster described in these remarkable words :—"The setting of plaster is due to hydration, *i.e.*, to its having not too much water to take up."

Seriously, it is a very great pity that such a specimen of bookmaking should be issued by a respectable firm. At the best it consists of an undigested mass of recipes, good, bad, and indifferent, with occasional commentaries which need not be characterised. Put into the hands of a competent man of science it might be cut down into a very handy little book of about one-fourth its present size. It would then be useful to the long string of trades enumerated on the title page ; at present its only value is as a mine for a skilled person to hunt out recipes from.

Glues and Gelatines : A Practical Treatise on the Methods of Testing and Use. By R. Livingstone Fernbach. London : Archibald Constable & Co. 1907. Price 10s. 6d. net.

This is a very useful and well-written book dealing with a difficult subject in a simple and practical manner. It is an American book, the English edition being simply the American with an English title page ; and, therefore, allowance has to be made for some peculiarities of American nomenclature and spelling. Thus it appears that the term "glue" is applied indiscriminately to a number of bodies of vegetable origin which in England would come under the designation of gums, such as Irish moss, agar-agar, dextrine and tragacanth—but this is a matter easily remembered, and therefore not likely to cause confusion.

The author points out the uncertainty of valuations based on viscosity, which appears to be very generally used as the sole test of value ; remarking that it is very fallacious unless other factors are taken into account. He also criticises the viscometers in use as originally designed for and standardised by means of oils, advocating a very simple instrument of his own as more rapid and sufficiently accurate for all glue testing purposes. At the same time he states that considerable variations in viscosity are shown by glues of identical sticking value, so that as before pointed out, this test by itself cannot be trusted.

He attaches more importance to the penetration test. This is effected by making a standard jelly and ascertaining the weight required to drive a disk of known diameter into it. The author calls attention to the fallacies that the formation of a skin may introduce in this test, but, curiously enough, he does not mention temperature, which must have a very important bearing on it, until he arrives at a subsequent section entitled "Jelling or Cooling the Glues."

He gives great praise to the English, German and French glues, particularly to the first, and says on page 87 : "Labour conditions are such in England and on the Continent that it is possible to subject both stock and glue liquor to operations precluded by the high cost of labour in the United States," which, if true, is a remarkable commentary on the alleged good effects of the Tariff. It would seem that in this case, at any rate, the manufacturer intercepts as profit that which it is contended goes to ensure the use of adequate labour where required to produce a good result.

He elaborates these opinions in his chapter on glues for cabinet-makers' work ; and though he says that, at equal prices, a native (U.S.) glue can be obtained stronger, he admits that the foreign glues are generally better, adding that "some piano makers will employ none but imported glues." The reason for this is that "too much of the domestic glue will be at the surface of the joint," so that though it is "as strong as the foreign," it "will not make so strong a joint." He attributes this to the excessive viscosity of the United States glues, which do not allow penetration into the wood fibre, hence we have here a case where a knowledge of the viscosity factor is valuable.

Having devoted 133 pages to the selection and testing of glues, the author gives a chapter on their use, one on commercial and legal aspects as between buyer and seller, one on manufacturing recipes and, lastly, one on analytical operations.

The latter contains a list of apparatus required from which thermometers are conspicuous by their absence, but, as the book winds up with the usual tables comparing English and metric weights, Fahrenheit and Centigrade thermometers, and the obsolete and troublesome Beaumé hydrometer with specific gravity, it is to be presumed that the operator is supplied with one or more.

On the whole, the book is well thought out, and clear and precise in its directions ; and it undoubtedly fills a vacant space. Not the least of its merits is that it keeps the motto "Ne sutor ultra crepidam" steadily in view, and, therefore, wastes no space on the chemistry of glues and gums—a chemistry which up to now is entirely devoid of practical value to the manufacturer or user.

BUSINESS NOTES.

Catalogues and Lists.—Adams Manufacturing Co., Ltd., Bedford.—Leaflets relating to their "Igranic" system of control for electrically operated rotary printing machines.

Messrs. Baxendale & Co., Manchester.—Price sheets relating to bell wires showing advanced prices consequent upon the high prices of raw material. The sheets are to be substituted for some in the catalogue already in our readers' hands. Also 8 pp. publication giving illustrations and prices of electric cooling and ventilating fans (table, ceiling, porthole, box-blade and battery fans) of the 1907 season (we write this with a cold shiver of August down our back!). As someone said the other day, "it has been such a mild winter this summer." The demand for cooling fans for use in this country must have been very small this year, though there is always a certain demand for them for ventilating purposes, and of course our suppliers do a very big fan business with foreign countries, we believe, practically continuously.

Siemens Bros. Dynamo Works, Ltd.—Booklet of 28 pp. (more modest in its size, form, style and so on than the Standard set of very acceptable Binder publications which were issued some little time ago), giving information concerning the company's electric meter manufactures. Ampere-hour and watt-hour meters, testing instruments, transformers, &c., which are mentioned as being manufactured either by Siemens-Schuckertwerke or by Siemens and Halske, are shown, and some brief descriptive matter relating to them, is given.

Messrs. Kramos, Ltd., Bath.—Circular No. 25 relating to their electric pulley blocks; No. 27, describing and illustrating their steel tube pattern standard resistance units; also leaflet No. 28 briefly particularising and pricing their small enclosed reversible controllers for cranes and hoisting machinery.

The Electrical Co., Ltd., London, W.C.—New pamphlet (No. 245) entitled "Sunshine after Sunset," in which the "Sunshine Flame" arc lamps are referred to and priced.

Messrs. Richd. Wade, Sons & Co, Ltd., Hull.—We have received a copy of a well-printed and bound catalogue of 90 odd pages, using art paper throughout, in which appears a great deal of very useful information concerning wooden poles for overhead power transmission and many other purposes. Diagrams and particulars of the construction of such poles, method of testing, ironwork for same, stay ropes, creosoting and its value, results of tests, tabulated data concerning wind pressure on transmission, telegraph and telephone wires, sizes of poles, diagrams showing the deflection, and shear or slip of poles with various amounts of spread at the feet—these may be taken as indicating the ground covered by the book. A large number of photographic views of poles, different types of poles used for English electric power transmission lines and other like service, are given. We have also received—and it forms a most fitting companion for a catalogue of this description—a reprint of the paper which was read by Mr. C. Wade before the Institution of Electrical Engineers last May, and the discussion that took place thereon.

Consular Notes.—Uruguay.—With reference to a series of articles on the Neutral Markets of the world recently published in the Electrical Review, and especially to that on "Uruguay," it is interesting to note that in a recent report on the trade of that country the British Minister at Monte Video calls attention, in connection with Uruguay's commerce with Europe, to the following words to be found in a commercial report recently addressed to the Government of his country by the U.S. Consul in Monte Video. "The Uruguayans, by reason of environment, race and language naturally prefer a trip to Europe. . . . Europe buys their bonds, builds their railroads and street-car lines, furnishes a large amount of their banking capital, and after investigating the financial standing of their merchants, gives long credit to the deserving ones. . . . Mercantile business in this country has been, and still is, very profitable, and there is no good reason why the American merchant should not have some share of the profit. The merchant and manufacturer of every other nation bring their products, supervise their sale, manage their business, study the wants and conditions, and accede to them. We send our produce to foreign merchants to sell in competition with the products of their own country, and yet are not satisfied with the results." The advice which the American Consul gives his countrymen should be taken into careful consideration by British merchants, if they do not wish to lose their present supremacy in the Uruguayan market. It must be remembered that their present commercial position in the profitable Uruguayan field of importation is due to the lack, until recent years, of opponents. Now, on the contrary, there are several competitors, and Germany especially, is a dangerous and persistent rival. At the risk of repeating well-known advice, it is necessary to warn British traders that they must "wake up," and become less conservative in their attitude, and more adaptable in their procedure. They must watch the market, study the people, learn their wants, acquire a knowledge of their language, and when they have done all this, they must endeavour, like German merchants, with ready eagerness to meet and satisfy those wants and requirements. Above all, catalogues and advertisements, labels and directions on goods, prices, weights and measures should always be translated into the Spanish language, which is spoken not only in Uruguay, but by over 30,000,000 people in the two Americas. Advertisements in local papers should be freely resorted to, and the fatal practice of employing foreign agents and foreign travellers to represent British interests should be abandoned whenever it is possible to replace them by British subjects, who will take the trouble to learn the language and to study and respect the idiosyncrasies of the people with whom they wish to transact business. German importers usually give long credit and renewals. Six and nine months are the common periods, with a discount of 5 per cent. if payments are effected within those periods, and there is, too, a readiness to extend those periods to twelve months if desired. British firms, on the contrary, never give credit for more than three months, of which at least one is lost after receipt of the bills of lading, before the consignments actually reach the warehouses of the agents in Monte Video. It is gratifying to know that, as a nation, England is respected and esteemed, and the British subjects and British enterprises can count, so far as the Uruguayan Government and people are concerned, upon fair treatment, so long, at any rate, as they maintain that high standard of commercial morality which has given to the phrase "La palabra de un Inglés," the popular meaning of honest and straightforward dealing. The Consul offers one further suggestion, that British merchants should bear in mind that Uruguay is geographically and politically a distinct country from Argentina, and they should, therefore, abandon the practice of appointing agents who reside in Buenos Ayres to represent them, and to push their trade, in Monte Video.

Japan.—The British Acting Consul-General at Yokohama, reporting recently on machinery in Japan, states that the import of machinery in 1905, value £951,274, was phenomenal, and was specially remarkable for the increase in electric motors and machine tools. In the latter item, the high figures were fairly maintained, but electric motors declined, and the total for machinery during 1906 fell to £848,509, which figures were, nevertheless, far above those of years prior to 1905.

Egypt.—The British Acting Vice-Consul at Alexandria, in a recent report on the trade of that port, states that in the past year there has been a considerable increase in the demand for electrical apparatus of all kinds. In 1905 the value of such imports amounted to £129,444, and in 1906 to £167,135. The supply comes mainly from the United Kingdom, France, Germany, and Austria-Hungary. Although the United Kingdom contributed considerably more than any other country, the value of her imports of electrical goods amounted in the past year only to £58,320, as compared with £63,557 in 1905. On the other hand, substantial progress was made by Austria-Hungary, and in a lesser degree by Belgium, whilst France and Germany also increased their share. Electricity is in general use in Alexandria for lighting, transport, and other purposes. There is a demand for ventilating fans of all sizes. Germany supplies large quantities of wires, lamps, bulbs, &c., to all of which British manufacturers should pay attention. Agents should be carefully chosen and preference should be given to men with some technical knowledge. The value of lamps imported to Alexandria, which to £47,414 in 1905 has increased to £63,696. The demand is principally supplied by Austria-Hungary, Germany, and France, all of which countries have made considerable progress in the past year. The United Kingdom's share in the supply has increased, but in a smaller degree. It would seem that a low price in this line, as in many others, is the first condition of success in Egypt. As regards the general trade of Egypt, H.M. Consul writes that the British origin of goods is here, as elsewhere, an accepted guarantee of merit, and not a few critics in this country aver that British manufacturers might even enhance their success, advocating (1) the adoption of the metric system; (2) the frequent visits of commercial travellers; (3) general adaptability to local requirements; (4) the quotation of prices in c.i.f. or any other terms required; (5) the reduction of prices so far as possible; (6) the acceptance of small initial orders; (7) accurate adherence to specifications; (8) great care and punctuality in the packing and delivery of goods; and (9) subject to due precautions, longer credits. It is impossible here to do more than comment on a few of these items of advice. As regards the fourth mentioned, whilst as a general rule all quotations should be c.i.f. Alexandria, since those terms only are accepted by native purchasers, sellers should be prepared to quote their prices in any other terms desired. One of the secrets of the not inconsiderable progress made by Germany in Egyptian and other commercial circles lies in the delivery of goods "free into customers' stores." Knowing, without further effort, the total cost of consignments, the buyer is thereby spared the laborious calculation of incidental expenses. It would be especially easy in the case of Egypt for manufacturers to quote prices *franco domicile*, for the Customs require an almost uniform duty of 8 per cent. *ad valorem*. As regards the eighth item of advice, the methods of packing wares have from time to time been criticised. It is said that big crates are preferable to boxes, especially for glass, for the latter are thrown from place to place with scanty ceremony by the native carriers at the docks. Freights would be economised if bulky goods such as furniture were packed in numbered parts. As regards the ninth item of advice, the length of credit to be given must always remain a question for each manufacturer to decide according to circumstances. Longer credit is certainly given here—especially by Continental manufacturers—than in most countries, and traders are guided in the quotation of their prices by the anticipation of delayed payment. With reference to machinery, the Consul states that for fixed and portable engines there is a corresponding demand, and preference is shown for those which are economical in fuel consumption. The position of the United Kingdom as regards these imports is highly satisfactory. Needless to say, it is necessary for manufacturers seeking to introduce new types of pumps or other machinery to be represented by first-class firms.

Aluminium Solder.—Messrs. T. W. Young, of 220, Old Street, London, E.C., have introduced an aluminium solder which is claimed to be effective, requiring only two agents for making repairs, viz., flux and solder, the soldering bit being such as is used by tinsmiths.

The Outlook on the European Continent.—A further note of warning in regard to the condition of the electrical engineering industry on the European Continent is contained in the annual report of the Bank for Electrical Enterprises of Zurich. This Swiss institution, which is essentially an investment company on an extensive scale from the fact that its combined share and loan capital amounts to £3,750,000, is also closely associated with manufacturing companies, and it used to be said that the bank's pronouncements really represented the views of the Berlin Allgemeine Co. However that may be, it may be recalled that, in their report for 1905-6, the directors of the bank expressed the fear that a revolution in the general industrial situation might easily be brought about in consequence of the dearness of money, taken in conjunction with the increase in the cost of raw materials, the more difficult conditions of labour, and other matters. Notwithstanding the continued favourable reports respecting the condition of industry and despite the recently expressed conviction in industrial circles that the period of industrial prosperity has not yet reached its highest point, the directors of the bank state, in the report for 1906-7 that it must now be generally admitted that the grounds for the apprehensions of a year ago have, in the meantime, become stronger. In fact, in their opinion, indications seem to be at hand that a certain weakening is gradually taking place in various branches of the industrial and commercial activity which has been impetuously pressed forward. Nevertheless, the companies intimately associated with the bank which make electrical machinery and apparatus have hitherto remained free from any limitation in their manufacturing operations, and the view presents itself without anything further, that the present condition of employment will still continue for a longer time, especially as electricity is becoming more and more introduced in mining and the iron and steel industry. As to the employment of metallic filament lamps, the report states that their use should render the electric light really capable of competing with gas illumination in respect of cost, as the tests as to the life of the lamps and the equality of the light have yielded admirable results. The question of main line railway working, to which the directors are devoting greater attention now that the experimental sections have given wholly satisfactory results, promises to reserve a large and remunerative sphere of business, and it is concluded that this will afford the bank an opportunity for profitable participation in the future.

Strike Settled.—A correspondent writes :—"After being idle for over a month, the employés of the GENERAL ELECTRIC Co., Salford, have arranged their differences with the firm, and are to be taken on again as soon as convenient, 36 of the 300 men being taken on last Friday, August 16th. The men say they have won a victory, and will go back on the terms for which they have been striving—namely, a wage of 38s. for 52 hours' work. The standard week is one of 53 hours, and prior to the dispute the wages paid were 37s. 4d. for a 52 hours' week, a reduction of one hour per week."

Electric Lifts for Olympia.—It will be remembered that the Easton Lift Co., of Westminster, made an exhibit of two electric lifts at the 1905 Electrical Exhibition at Olympia, which, during the time it was open, carried, we are told, over 400,000 passengers. The advantages of providing an additional and quick means of access to the galleries in the building, other than the numerous staircases, was so apparent, and the working of the lifts so highly satisfactory, that the New Olympic Co. have now placed a contract with the Easton Lift Co. for the permanent erection of two of their latest and most recently improved types of electric passenger lifts. This order may, we suppose, be regarded as an instance of the lasting effect which the 1905 Electrical Exhibition has doubtless had in many directions.

Book Notices.—*Manipulations et Mesures Electriques et Magnetiques Industrielles.* By H. Pécheux. Paris: J. B. Baillière et fils. Price 6 fr.—The title of this work clearly indicates the nature of its contents. The author deals first with the fundamental laws and definitions relating to the subject, and describes the various standards of measurement, after which he treats at length of the actual apparatus and methods of measurement adopted in industrial laboratories. The treatment is essentially practical, and the application of every instrument is described, due attention being given to the degrees of accuracy obtainable and the precautions to be observed. No untried method has been included. The book should be of considerable utility both to students and to those engaged in practical work.

The Teaching of Elementary Mechanics. Edited by John Perry, F.R.S. London: Macmillan & Co. 1906. Price 2s. net.—Prof. Perry is nothing if not thorough; his enthusiastic efforts to bring about a reform in the teaching of engineering mathematics have already borne abundant fruit, and he neglects no opportunity of furthering his views. To this end, he has published in this small volume the discussion which took place on the subject at the B.A. meeting of 1905, together with a paper by Mr. C. E. Ashford, read at the B.A. meeting last year. The discussion was introduced by Prof. Perry, who advocated the use of measurement from the earliest stages of a child's education. After the age of 10, experimental science should be commenced, taught in an interesting manner, and by the age of 14 a boy should be able to tackle graphical and experimental work in statics and dynamics in general, great stress being laid upon true understanding gained by illustration and experiment; abstract proofs of propositions are easily followed when the ideas have been properly inculcated. The discussion which followed was exceedingly interesting, the speakers being by no means unanimous. The vexed question of the "poundal" was, as usual, to the fore. In response to Prof. Perry's request, a number of authorities who were not present at the discussion contributed written expressions of opinion, and Prof. Perry's reply is appended to the whole. The book forms a useful record of the various opinions put forward.

Economies in Works Costs. By C. J. Hall, M.I.E.E., Leeds. From the author, price 1s.—In this 16-page booklet the author points out where and how economies can be effected in existing works or mills. He shows how losses are incurred through the use of old-fashioned engines, long steam pipes and shafts, and how they can be largely reduced by substituting an electrical drive, generating electrical energy at a cost of ¾d. to 1d. per unit. A glossary of technical terms is given, with a few additional items of information.

Heat Shadows. By W. Jamieson, B.Sc. London: Blackie & Son. 1907. Price 6d. net.—This is an account of some new experiments in conduction and radiation of heat, devised by the author. They depend upon his invention of a mode of sensitising paper, so that on exposure to heat the part affected turns bright green; the colour immediately fades on cooling. The experiments are extremely interesting and ingenious, and the method will serve to demonstrate in admirable fashion the effects of many laws which hitherto it has not been possible to exhibit to the eye in a satisfactory manner.

"Socialism: Its Fallacies and Dangers." By Fredk. Millar. London: Watts & Co. Price 6d.

"Buckle, London." By P. T. White. Wigan: Roger & Rennick. Price 6d.

"Die Elektrischen Bahnen und Ihre Betriebsmittel. By H. Kyser. Brunswick: Friedr. Vieweg und Sohn. 1907. Price M. 5.50.

"Transactions of the North-East Coast Institution of Engineers and Shipbuilders," Vol. XXIII, Parts 8 and 9. August, 1907. London: Andrew Reid & Co.

"Rules and Requirements of the National Board of Fire Underwriters for the Installation of Electric Wiring and Apparatus, 1907." ("National Electrical Code.")

Air Compressor Contracts.—Amongst the orders recently received by MESSRS. W. H. BAILEY & CO., LTD., of Salford, for their "Koster" patent air compressors, is one for the South Eastern and Chatham Railways, capable of dealing with 60,000 cb. ft. of free air per hour, and another for the Daimler Motor Co., Ltd., to deal with 14,000 cb. ft. per hour.

Armorduct in Japan.—We understand that the sale of "Armorduct" conduit is making very satisfactory progress in Japan. The Armorduct Manufacturing Co., Ltd., have just received advice from an important customer that the New Palace for the Crown Prince, and Baron Iwasaki's new house, are two of the important installations in hand at present.

Large Circuit-Breakers.—With reference to our article on the electrical equipment of the Hammersmith and City Railway, we are informed that the low tension circuit-breakers, some of which are overload and some of reverse type, were all manufactured by Messrs. Bertram Thomas, of Manchester. The capacity of some of the breakers is 6,000 amperes.

Ceylon.—CATALOGUES OF ELECTRICAL GOODS WANTED.—The Commercial Intelligence Branch of the Board of Trade are notified by the Crown Agents for the Colonies that manufacturers of electrical supplies, plant, fittings and measuring instruments, are invited to send their latest catalogues and price lists for the use of the Government of Ceylon. The catalogues should be endorsed "Catalogues of Electrical Materials," and be addressed to the Comptroller of Government Stores, Colombo, Ceylon.—*Board of Trade Journal.*

Holidays.—The works and offices of Ferranti, Ltd., at Hollinwood, are to be closed for the annual district holidays from August 30th to September 9th.

Australia.—The Australian Customs authorities have lately given a decision to the effect that "Accumulators, parts of forks (ebonite) and rods, ebonite and glass cut into lengths for fitting into accumulators," are to be classified as "electrical materials," and admitted free of import duty. "Other rods, ebonite," are to be classed as "india-rubber materials," and pay a duty of 15 per cent. *ad valorem*, and other rods, glass, "as glassware," the duty in this case being 20 per cent. *ad valorem*.

Conduits and Fittings, Ltd.—A statement of affairs has been issued by the receiver (Mr. H. Douglas Brown, 4, Monument Street, E.C.), showing a deficiency as regards creditors of £1,021. There are debentures and debenture charges of £2,045, and unsecured creditors amounting to £1,582. The stock-in-trade, plant, furniture, book debts, and cash and bills in hand, are estimated to realise £2,689 (less £83 preferential creditors). Stock in South Africa cost £326, but its actual value it is difficult to estimate. For the present Mr. Brown is continuing business on behalf of the debenture-holders.

Bankruptcy Proceedings.—G. M. SELLICK, manufacturer of electrical accessories, Romford Road, Forest Gate.—First and final dividend of 3s. in the £, payable at Bankruptcy Buildings, Carey Street.

C. M. VENN & Co., electrical engineers, 5, Park Parade, North Finchley.—A receiving order was made at Barnet Court on August 16th on a creditor's petition.

The Montreal Electrical Exhibition.—In referring to this Exhibition, which, as we have already stated, is to be held early next month, the *Montreal Star* says that the Exhibition and convention combined will be the greatest affairs of their kind ever seen in Canada. The convention would have swelled to enormous size had the officers of the Canadian Association so desired, but the utter impossibility of securing sufficient hotel accommodation was a factor instrumental in compelling the members to decline the offers of various associations to come to Montreal. When it became known that there was an electrical convention arranged for Montreal, the members of the committee in charge were fairly inundated with requests for particulars, and had the city been able to furnish proper accommodation for guests there would have been a "record-breaker" in the convention line. "The brethren to the south were very anxious to come, but many offers were necessarily declined. However, there will be a very representative gathering from the United States. The members of the French body were also very keen on coming to Montreal, and were ready to flock here in numbers, but the same lack of hotel accommodation prevented their coming. There will be a good representation from the English workers." The Exhibition will be far ahead of anything of the kind seen in Canada. It will be devoted to a demonstration of electrical wares and of the various uses of the power. Lighting, heating and cooking will be shown in various applications, and a whole section will be devoted to showing what uses electricity may be put to by the housekeeper.

Klein Condensers.—The Klein Engineering Co., Ltd., Manchester, inform us that they have received orders recently for the following Klein condensing plants and cooling towers:—

Per Siemens Bros. Dynamo Works, Ltd.—One barometric jet condensing plant for 32,000 lb. of steam per hour, to be erected at the Ark Mill, Bredbury; one ditto and cooler to deal with 17,000 lb. of steam per hour for the Falcon Mill, Bolton; one ditto for the Huddersfield Corporation, to deal with 30,000 lb. of steam per hour. The above three plants are intended to give a vacuum of 28 in., and to work in conjuction with exhaust steam turbines.

Per Willans & Robinson, Ltd.—One barometric jet condensing plant to deal with 35,250 lb. of steam per hour, and to give a vacuum of 27½ in.; this plant is also to work in conjunction with an exhaust steam turbine; barometric jet condensing plants and coolers have also been put in operation quite recently for Messrs. John Brown & Co., Atlas Works, Sheffield, and at the Bolton Corporation Electricity Works, the vacuum obtained being 28 in. and 27½ in. respectively, the plant at Messrs. Brown's working in conjunction with an exhaust steam turbine. The company have also in hand barometric counter-current jet condensing plant for Bombay.

Per Fraser & Chalmers, Ltd.—One Klein natural draught chimney cooling tower, to deal with 100,000 gallons of water per hour.

For East Ham Borough Council.—One steel plate forced draught cooling tower, to deal with 60,000 gallons of water per hour.

Trade Announcements. — Mr. F. H. Preece, A.M.I.E.E., has opened an office at 27, Clement's Lane, E.C., where he is practising as agent and engineer for mechanical, steam and electrical plant. He will also carry out the inspection and testing of steam and electrical plant.

The office of Messrs. J. S. Cunnington & Co. has been removed to 7, Great Newport Street, St. Martin's Lane, W.C., where they are also carrying on the business of the late "Improved Electric Supplies."

Messrs. John I. Hall & Co. announce that in order to deal more effectually with the growing business in Wilkinson's feed-water heaters, they have removed from Kingston to Craven House, Kingsway, London, W.C., to which address all communications for the firm should now be sent.

Dissolutions and Liquidations.—York Electrical Co., Ltd.—This company is winding up voluntarily with Mr. C. A. Rymer, Yorkshire Bank Chambers, York, as liquidator.

Hansard & Watson, consulting electrical engineers, Parliament Mansions, Victoria Street, S.W.—Messrs. A. G. Hansard and H. S. Watson have dissolved partnership. Mr. Hansard attends to debts.

Dewsbury Electric Manufacturing Co., Ltd.—A meeting is to be held at 9, Charles Street, Bradford, on September 25th, to hear an account of the winding-up from the liquidator, Mr. R. S. Dawson.

Fire.—According to the daily Press a somewhat serious fire occurred on 17th inst. on the premises of Messrs. Rawlings Bros., Ltd., electrical engineers, Lenthall Place, Gloucester Road, Kensington. It appears to have originated in the accumulator room.

Mining Exhibition, 1908.—Prospectuses are in circulation relating to "The World's Great Mining Exhibition," which is being promoted by Mr. H. Greville Montgomery, M.P., and is to be held at Olympia in July next year. Members of the National Electrical Manufacturers' Association are free to exhibit here if they so desire.

Annual Outing.—The workpeople employed at the Anchor Co.'s Cable Works, at Leigh, South Lancashire, recently went for an outing to the "Dukeries," Worksop.

Nernst Street Lighting.—In a communication to the A.E.G. English Manufacturing Co., Ltd., the Chelmsford Electric Lighting Co., Ltd., relate their experience of Nernst lamps for street lighting. During the past year 307 of the lamps were erected in the town under a guarantee of 500 hours per burner. According to this the lighting company should have replaced 2,252 burners, whereas the actual number replaced was 1,978, showing a life of 572 hours per burner.

LIGHTING and POWER NOTES.

Ashton-under-Lyne.—Application is to be made for borrowing powers of £11,673 for mains extensions.

Belfast.—For the half-year ended June 30th, according to Mr. Bloxam's recent report, the revenue for lighting and power—excluding city tramway supply—shows an increase of 11·4 per cent. over the corresponding period of last year. The sale of units for lighting shows an increase of 17·5 per cent.; ditto for power, an increase of 22 per cent.; for tramways, an increase of 19·1 per cent.; for all purposes, an increase of 19·2 per cent.; total output for half-year 5,169,044 units.

Canada.—According to a cutting from the *Montreal Gazette*, residents of Woodstock, N.B., are now depending upon candles for the lighting of their premises, as a recent series of fires led the New Brunswick Insurance underwriters to threaten to cancel all insurances if the plant of the Electric Light Co. were started on August 6th. The entire electric lighting of the town has, it appears, had to be shut down until satisfactory arrangements can be made and the rewiring of the town completed.

Colne.—A L.G.B. inquiry was held last week regarding the proposal of the Corporation to borrow £5,550 for the purposes of the electricity undertaking. The consumption of current had increased to such an extent, said the town clerk, that in the case of an accident or breakdown to the large dynamo, the supply would have to be restricted. As the Corporation supplied current to the Colne and District Light Railway, any failure might render it liable to penalties. The proposed new plant consisted of a 360-h.p. dynamo, driven by a triple-expansion engine of 550 h.p., a duplicate of the present engine.

Continental Notes.—Italy.—Application has been made to the authorities of the Province of Lucca for a concession to put down a plant to utilise the water-power of the River Serchio at Bargo in the generation of electrical energy for lighting and power purposes. It is estimated that about 1,250 h.p. is available.

The Provincial Giunta, which is a body having the functions of a Local Government Board, has submitted to the various local authorities (parishes) of Rome a proposal for the municipalisation of the supply of electricity, and the erection of a municipal generating plant.

Austria.—The municipality of Vienna has decided to extend its electrical works at a cost of 6,000,000 kronen.

Coventry.—On August 14th a L.G.B. inquiry was held into an application by the Corporation to borrow £27,000 for extension purposes. The town clerk explained that this was part of a larger scheme which would be the subject of future application. It was in the last six months that the increased demand had been most apparent, and that was why no hint of this loan was given at the inquiry held a few months ago, when a similar application was inquired into. The scheme met with no opposition.

Gravesend.—The T.C. has reduced the price of energy for lighting from 4½d. to 4d. per unit on the flat rate, and on the maximum demand rate from 7d. and 2d. to 7d. and 1½d.

Hetton-le-Hole (Co. Durham).—As an experiment, the U.D.C. has decided to have 10 electric lamps placed in the streets of the town. Current will be supplied by the local E.L. company at 27s. per lamp per annum. The surveyor is to report later as to the cost of such lighting in comparison with gas lighting. The general question of electric lighting for the district has been deferred for 12 months.

Hornchurch (Essex).—Mr. G. A. Browning, of Seven Kings, has approached the P.C. with reference to an E.L. installation at Hornchurch, a district which is rapidly developing, suggesting the use of overhead wires. A committee has been appointed to consider the matter.

Lichfield.—Owing to the E.L. order having lapsed, the T.C. has decided to claim the sum of £175 from Messrs. Foote and Milne, due under an agreement.

Melbourne.—The P.C. has accepted the offer of Mr. Underwood to supply current for 25 public lamps at 15s. each per season, and for two arc lamps at £5 each.

Ossett.—The *London Gazette* of August 20th contains notice of terms of the transfer of the U.D.C. prov. order to the Electrical Distribution of Yorkshire, Ltd.

Penshaw.—The P.C. has decided, in conjunction with Newbottle P.C., to try to make arrangements with the Durham Collieries Electric Co. for a supply of current.

Portsmouth.—The T.C. at its last meeting had the electric lighting accounts before it. The balance of £10,853 is to be dealt with thus:—Insurance fund account, £1,000; reserve fund account, £5,991; general district rate, £3,500; revenue contribution to capital outlay, £662. A new scale of charges has been approved, the object of which is to retain or attract the large consumer who might have an inclination to put down his own private plant.

Peterborough.—At an L.G.B. inquiry last week into th pplication of the T.C. for a loan of £3,000 for electricity mains and feeders, the Ratepayers' Association offered opposition.

Rawtenstall.—The T.C. is applying to the L.G.B. for sanction to a loan of £34,000, not £29,000 as originally proposed, for an electricity generating station at Hareholme and the necessary mains and equipment for electric light, power and traction supply for the borough.

South Africa.—JOHANNESBURG.—At a meeting of the Town Council held on July 17th, approval was given to the recommendation of the Tramway and Lighting Committee that an arrangement be made with the Victoria Falls Power Co. for a supply of 1,300 KW., three-phase at 3,000 volts, to be delivered at the city and suburban transformer station, to terminate on June 30th, 1908, at 4d. per unit, with a minimum of £200 per 100 KW. per month. In the event of the Council agreeing for a full supply in bulk from the company, the price would be reduced to 3d. per unit and a minimum of £150 per 100 KW. per month. The reports of the general manager and the local experts engaged, and also the offer of the Victoria Falls Power Co., came up for consideration. The general manager, in his report, dealt with the capital cost to the Council in installing new steam plant in the present gas engine station, and the works costs of production of current as compared with the Victoria Falls Co.'s offer. He stated that the present tramway and lighting demands were a maximum of 2,100 KW. for D.C. lighting, 1,000 KW. for traction, and 1,800 KW. for A.C. lighting, making a total of 4,900 KW. The existing plant for D.C. lighting, which would be suitable for the permanent scheme is 1,650 KW., which gives a shortage of 1,450 KW., and to meet this, steam dynamos totalling 2,500 KW. are required. New plant is also necessary for the A.C. supply, amounting to 6,650 KW. The capital cost of new steam plant and the cost of 5,000 KW. in generators and of moving the existing plant, is estimated at £120,000, and on an assumption of 11,000,000 units per year, it is estimated the works cost would be 1·15d. at the switchboard, and adding interest, &c., a total cost of about 1·583d. The Victoria Falls Co. offered to supply 1,000 KW. at 2½d. per unit within four months under certain conditions, and after 22 months at 1·25d. per unit on a 10 years' contract, but the general manager reported on the advisability of the Council installing their own plant. Pending a statement by the gas plant contractors, the Council felt unable to decide what to do, and it was felt that for the meantime only the immediate requirements need be met, and that an additional 1,000 KW. would enable the Council to meet urgent demands. The Victoria Falls Co.'s offer they were not at present prepared to accept, and it was decided to call for tenders for one 1,000-KW. or two 500-KW. sets of either reciprocating engine generators or steam turbine generators, at an estimated cost of £17,000. At the same meeting the Council authorised Mr. Jeppe, chairman of Electric Light Committee, to proceed to England in connection with proceedings which were being instituted for the non-fulfilment of the gas plant contract. The Council also decided on retrenchment to the extent of £618 in the electric supply, and £5,196 in the tramway branch, by reducing various salaries and allowances, and further reductions are anticipated.

South America.—The *Review of the River Plate* of July 19th says that "about August next" the Paraguayan Capital, Asunción, will be lighted throughout by electricity.

Swinton and Pendlebury.—The U.D.C. has decided to have the public baths, Council offices, and town hall, wired for the E.L. at an estimated cost of £289.

Wath-on-Dearne.—The U.D.C., with the view of carrying out the E.L. order, which expires at the end of the year, has appointed a deputation to visit several installations, and report.

Willington (Co. Durham).—The U.D.C., which is considering a scheme of E.L., has decided to seek the advice of Mr. Laws, of Gateshead. The Crook U.D.C. has offered to supply current by underground mains at 3⅜d. per unit.

TRAMWAY and RAILWAY NOTES.

Belfast.—The Harbour Commissioners have approved of a recommendation for the submission to the city surveyor, for approval, of the contract, specification, plans, &c., for the electric tramway along the Queen's Road. The proposed line will connect the city with the great shipbuilding firm on the Queen's Island, in addition to developing new routes.

Bradford.—The report of the general manager of the tramways shows that the total revenue for the year was £237,511, an increase of £8,533; the car-mileage amounted to 5,167,261, an increase of 133,000, and 46,728,977 passengers were carried. The total expenditure was £164,987, leaving a gross profit of £72,524, against £70,279 in the previous year; during the year the price paid for electrical energy was increased by ½d. per unit, representing an extra charge of £5,534. The parcels business produced an income of £5,004, the expenditure being £4,032. After payment of capital and other charges amounting to £61,219, a net balance, including bank interest, of £14,536 was left, as compared with £11,637 in the previous year. Of this, £10,000 was allocated to relief of rates, and the remainder to the reserve and renewals account. The latter amounts to £38,024: the manager regards a reserve of £90,000 or more as not too much, the capital being nearly a million, and says he cannot recommend the Council to hand over large sums of money to relieve the rates.

Continental Notes.—AUSTRIA.—According to a correspondent of the *Pall Mall Gazette*, in order to facilitate and accelerate the collection and delivery of letters and packages in Vienna, the Ministry of Commerce is engaged upon a plan for an underground electric railway which would link together the chief and various district post offices of the city, some 64 in all. The line would be built 25 ft. below the surface of the ground, and the tunnel would have a height of 5 ft. and a breadth of 4 ft. 4 in. The stations would be built underneath the post offices. The trains would run at 20 miles an hour, and would consist of a motor and three cars, each carrying as much as the ordinary post van. Obviously, this is London's old "pneumatic dispatch" over again. But the London tube is derelict, and we doubt whether such a scheme would result in economy either here or in Vienna.

GERMANY.—The long-standing problem of the projected transformation of the Berlin city and suburban State railways to electric traction has now reached a further stage by the action of Herr Breitenbach, Prussian Railway Minister, who has ordered the State railway authorities in Berlin to proceed with the preparation of schemes and estimates in connection with the work. According to the Minister's order, it is proposed, in the first place, to introduce electrical working on the city and circle railways, as well as on those suburban lines which are directly connected with the city network, that is to say, on the suburban lines which pass over the city railway, and also the Wannsee railway, which was worked electrically as an experiment in the years 1900, 1901 and 1902. All these sections have to be converted by the end of 1913, and afterwards the suburban lines to Bernau, Oranienburg and Tegel will be taken in hand, the remainder of the outlying lines following subsequently. In this way the whole of the work of transformation will be completed by the year 1920. Apart, however, from this period for conversion, the calculations of the railway authorities are to be so based that it will be possible in 1913 to commence working from a State power station the city and circle lines, the connecting sections and the Wannsee railway, together with the supply of light and power for all the railway stations and workshops in greater Berlin. It is suggested that the power station should, if possible, be located in the suburbs, and transformer stations erected in various places. The Ministerial order proceeds to set forth for prospective use the type of double car made by the Allgemeine Co., and used experimentally on the Spindlersfeld suburban railway. These cars can be used singly or several coupled together so as to form a train, and they would permit of the establishment of a two minutes' train service. This would increase the service which is rendered at present, and it would be possible to work the suburban traffic at a speed of 37 miles an hour. It is not expected that the city railway, which has failed to keep pace with the needs of the public for a long time past, will meet all the requirements of the situation even on transformation to electric traction. In the circumstances the provision of another double track is foreshadowed, but the Minister leaves it undecided whether this should be effected by means of an underground railway, or whether it should be built as an elevated structure over the route of the existing city railway, which would then become a double-storey railway. It is estimated that the work of transformation would involve an expenditure of £9,000,000.

SWITZERLAND.—The experience gained in the working of the railway through the Simplon tunnel is referred to in the annual report of Messrs. Brown, Boveri & Co. for 1906-7. It is mentioned that the operation of the railway has hitherto fulfilled all expectations, and has undoubtedly increased general confidence in the electrical working of main lines. Instead of the prescribed load of 400 tons, the locomotives have repeatedly hauled trains of 650 tons. The company has put in hand two heavier locomotives, which will be ready for placing in service in a few weeks, and are to serve as substitutes for the engines lent by the Italian State railways. The whole installation in connection with the Simplon represents an important financial transaction for Messrs. Brown, Boveri & Co., the directors of which firm express the confident hope that on the expiration of the agreement the installation will be taken over by the Swiss Federal Railway Administration. Apart from the fact that the payment which the Federal railways have granted for each locomotive-mile run from the beginning is less than the cost of an equivalent steam service, the account is further prejudiced by reason of the risks embodied in the working agreement, which compel the company to undertake extraordinarily high expenses for insurance, whilst at the same time the independent working management of such a short section by a private undertaking leads to high personal costs. As a consequence the working account shows a deficiency for the first year, and this will approximately be repeated in the second year if relief is not afforded by the Federal railway administration. The directors of the Swiss company conclude that the successful operation of the Simplon railway will result in an enlivening of the railway business, and they state that certain signs of it are already at hand.

Eccles.—Major Cardew, the arbitrator appointed by the B. of T. to fix the price to be paid to Eccles by the Salford Corporation for the electricity required for working the Salford tramcars in the Eccles district, has issued his award. At the inquiry it was contended on behalf of Eccles that Salford should pay 2d. per unit, and Salford contended that 1·15d. per unit was sufficient. The arbitrator has fixed the price at 1·33d. per unit for the first half-million units, and 1d. per unit for all above that quantity. Eccles has to pay its own costs and those of the arbitrator. Prior to the arbitration Salford offered to pay Eccles 1·35d. per unit, but this was not accepted. The cost of the proceedings will amount to about £500, and as the Eccles Corporation is already running its station at a loss, Major Cardew's award will add to its financial burdens.

London.—Through Booking.—Arrangements have been completed between the Hampstead Tube and the Central London Railway for the issue of through tickets between their respective systems. The new through fares are based on a system of zones. The following are some of the charges:—

Golder's Green to any Central London Station	4d.
Hampstead to G.P.O., the Bank, and stations west of Bond Street	4d.
Belsize Park, Chalk Farm, Hampstead, Tufnell Park, Kentish Town and South Kentish Town to any station west of the Marble Arch	4d.
From the foregoing stations to any station east of Lancaster Gate	3d.
Camden Town or Mornington Crescent to any Central London station	3d.
Euston to General Post Office, the Bank, and stations west of Bond Street	3d
Euston to stations east of the Marble Arch as far as Chancery Lane	2d.
Euston, Charing Cross and intermediate stations to stations east of Lancaster Gate as far as Chancery Lane ...	2d.

The new fares will come into operation on September 1st.

L.C.C.—Much dissatisfaction is still manifested by the drivers and conductors in the employ of the L.C.C., who refuse to see that the public have a right to make sure of the physical fitness of the men to whom they entrust their lives. A mass meeting of over 800 men, during the small hours of Sunday morning, was held to protest against this reasonable requirement, and it was announced that the order for medical inspection had been cancelled, but that the matter would be considered when the Council met in October. As usual, the opportunity was seized to agitate for more pay and less work, and the Belfast experiences were referred to.

The West Ham and Leytonstone authorities are applying to the B. of T. with a view to delaying the adoption of the surface contact system in Stepney until the Stepney B.C. has again been requested to withdraw its objection to the trolley system. It is pointed out that the change of system will interfere with through running, and that Poplar has already withdrawn its opposition to the trolley.

Traffic Board.—In Parliament on Monday, Lord Ribblesdale asked the Government what duties were to be attached to the special branch of the B. of T. recently constituted for the purpose of dealing with matters relating to London traffic; and whether it was intended that this branch of the B. of T. was to be entrusted with any, and if so which, of the functions which the report of the Royal Commission on London Traffic recommended should be vested in a traffic board. The Earl of Granard said the Government had not found themselves able to bring in the Bill that would be necessary to set up the Traffic Board recommended by the Royal Commission; and being anxious to do something to improve the condition of London, they thought that could best be effected by appointing a London traffic branch of the Board of Trade. The Board would report to Parliament yearly on the needs of London traffic. They would endeavour to bring into harmony the different schemes of locomotion seeking statutory powers, by means of conferences between the parties concerned. He understood that something could be done by way of amending standing orders relating to private Bills, so that they would have to go before this branch of the Board of Trade before they came before Parliament; possibly next year something might be done in that way. Although the branch had only been working for a week or so, they had already had two or three schemes submitted to them for approval. The matter was not in any way permanent; it was leading up to a larger policy. Whether a permanent settlement of the subject would be by means of a traffic board, he was not in a position to say.—*The Times.*

Portsmouth.—The annual report of the general manager of the Corporation tramways for the year ending March 31st shows that the total revenue was £102,015, and the working expenses £45,755, leaving a gross profit of £56,260, as compared with £56,290 last year. After paying to sinking fund £16,217, and interest £19,697, with other items, there remains a balance of £18,269, of which £6,261 is carried to renewals fund, £2,791 to special reserve, and £5,000 to aid of rates. Last year the balance was £18,635; the renewals fund received £15,114, and the rates £3,500. The total working expenses amounted to 4·99d. per car-mile, compared with 5·15d. last year, and the traffic receipts were 10·79d. as against 11·06d. The percentage of working expenses to total receipts was 44·85. Mr. Spaven points out that renewals are now taking place each year (the tramways were opened in 1901), and that it is necessary to provide a fund to meet the cost, as "the periods for which the loans are granted are much longer than the life of the various parts of the undertaking." With the tramways engineer, Mr. V. G. Lironi, and the borough treasurer, he has drawn up a report on the subject. An exhaustive investigation of the condition of the track and overhead construction has been carried out for this purpose. The life of the loans is taken at 27 years, during which period, it is estimated, £244,750 will have to be spent to keep the permanent way in working condition. The trolley wire and ears will require complete renewal between the 12th and 14th years, at a cost of £16,418. The outlay on the generating plant is estimated at £7,300, and on buildings, &c., £2,793, while car equipments will cost £25,000. To meet the cost of these renewals, a sum of £10,971 per annum is necessary, and this has been provided, the renewals fund (less expenses already incurred) now standing at £48,695. To meet contingencies, such as breakdowns, fire, &c., a special reserve fund is recommended, to be formed at the rate of £2,500 per annum until it reaches the sum of £12,500. The total capital outlay amounts to £670,157. The report is accompanied by a mass of interesting data relating to the working of the tramways, curves shewing the weekly and monthly traffic, meteorological observations, &c. The total number of units generated at the tramway power station was over three millions, costing 0·537d. per unit, or with capital charges, 0·819d.

TELEGRAPH and TELEPHONE NOTES.

Burma.—According to *Indian Engineering*, telegraph masts 140 ft. in height are to be erected near Shwegun, in the Thaton district, Lower Burma, for the purpose of carrying the wires across the Salween River.

New Cable.—The laying of the 1,500-km. cable between St. Petersburg, Libau and Copenhagen, undertaken by the Great Northern Telegraph Co., and carried out by the North German Sea Cable Works at Nordenham, has been completed. The cable steamer *Stephan* has been occupied with this laying since February.

Pacific Cable.—The accounts for 1906-7 show that the total revenue from the cable was £116,402, as compared with £94,456 in the previous year; the net revenue was £113,516, and the expenditure £90,895, leaving a gross profit of £22,621. Against this must be set interest and sinking fund payments amounting to £77,545, leaving a deficit on the year's working of £54,924. Last year the deficit was £72,556.

Telegraphists' Strike in U.S.A.—The strike continues with no sign of an approaching settlement. Each side claims to be winning, and various wild statements have been published as to what the respective parties can and will do. The telegraphists are said to have engaged counsel to appear before the State Attorney-General and demand the annulment of the charters of the companies for sending messages by post and express. The operators propose arbitration, but to this the companies will not consent. A general strike order has been issued by the leaders of the union, "to regularise" the position of the men, who have actually been on strike for a fortnight. Appearances are in favour of the employers, who are handling their business with some show of order.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Curacao-Coro Curacao-La Guayra } Closed.. Curacao-Maracaibo	.. .. .. Jan. 12, 1906 ..	..
Reissa-Issa and Reissa-Yemani (Yemen) ..	.. Oct. 22, 1902 ..	..
Tarifa-Tangier	.. Jan. 18, 1904 ..	..
Port Arthur-Chifu (Closed)	.. Mar. 9, 1904 ..	..
Garachico-Santa Cruz	July 12, 1906 ..	..
Las Palmas-Arecife	Aug. 18, 1906 ..	..
Brest-Dakar	July 22, 1907 ..	..
Accra-Lagos	Aug. 11, 1907 ..	..
Lagos-Bonny	Aug. 11, 1907 ..	Aug. 15.
Landlines.		
Puerto-Barrios	Aug. 2, 1902 ..	..

Wireless Telegraphy.—In connection with the allegation of the Marconi Wireless Telegraph Co., of Canada, that the Canadian Government had not kept faith with the company, the Acting Minister of Marine, Mr. Templeman, has issued a reply, published in the *Times*, stating that the company refused to accept licences for three Canadian Pacific steamers, because they provided for free intercommunication with all systems. This condition was made in anticipation of Great Britain's adhesion to the Radio-Telegraphic Convention. The Dominion De Forest W.T. Co. accepted the licence for a trans-Atlantic wireless station on Grindstone Island, near the mouth of the Gulf of St. Lawrence, without objection. Mr. Templeman explains that the licences for stations along the St. Lawrence, concerning which the Marconi Co. complained, were delayed merely for reference to the British Colonial Office, and are now ready for issue.

The delay of a few weeks in opening the Government stations on the St. Lawrence was unfortunate, but was not intended to injure the company. The latter has built and equipped 15 stations for the Government, and three on its own behalf. On the Pacific Coast the Government has adopted a different system on account of the refusal of the company to communicate with other systems. Summing up, the Acting Minister declares that the Government intends to control wireless telegraphy in Canada, a policy which is identical with that attributed to the Marconi Co.

In the *Times* of Tuesday last the Canadian manager of the company is reported to have replied that the company did not refuse

to give intercommunication with other systems on the Pacific Coast, and that negotiations were in progress when the Government suddenly purchased the apparatus in the United States. He regarded Mr. Templeman's statement as a declaration of a despotic policy of confiscation.

The *Powerful*, flagship of the Australian Squadron, has succeeded in establishing communication with the cruiser *Challenger* over a distance of 700 miles.

CONTRACTORS' COLUMN.

Openings for New Business.

ARNSIDE (Westmoreland).—Detached residence and alterations to "Llang warren." R. B. Barker, architect, Arnside.

ATHERTON (Lancs.)—New spinning mill (£80,000). J. W. Cowburn, builder, Leigh, Lancs.

AYLESBURY.—Important extension of printing works. Hunt, Barnard and Co. 20, Blandford Street, Paddington, owners.

BIRKENHEAD (Liscard).—Extensions to Congregational Church premises (£2,500. Rev. W. Major Scott, minister.

BOLTON.—New warehouse in St. Helena Road, for R. Walker, Ltd.

Alterations to buildings for Magee, Marshall & Co., brewers, Bolton.

Additions to Savile Street mill, for T. Taylor.

New cement store in Dijon Street, for R. Walsh.

BOULTON.—Extensions to Parish Church (£1,200). J. Nuttall, M.S.A., architect. Messrs. Ford & Sons, contractors, Derby.

BRADLEY (Staffs.).—Extensions to Bradley Council Schools (468 places). G. Balfour, Director of Education, County Education Offices, Stafford.

BRAMPTON.—Alteration of White House to secondary school (£3,000).

BRIDGEND (Maesteg).—Offices for North's Navigation Collieries, Ltd. J. P. Gibbon, Mining Offices, Maesteg.

BROADSTAIRS.—New Roman Catholic Church.

CALLANDER (N.B.).—Alterations, &c., at United Free Church (£2,500).

CARDIFF (Gelligaer).—New station at Llancaiach for the Great Western Railway Co. (£12,000).

CASTLEREA (Ireland).—New memorial hall and schools. W. H. Byrne and Son, architects, 21, Suffolk Street, Dublin.

CAVAN.—New bank house for the Hibernian Bank, Ltd. E. J. Toye, architect, 20, Great James Street, Londonderry.

CHESTERFIELD.—Business premises for the T.C. in Burlington Street.

COMRIE (Perthshire).—New villa for Mr. Boston, Larklea. James McCowan, builder, Comrie.

Shop and workshop for John Robertson, tailor. Sharp & Stalker, builders.

CONGLETON.—Residence in Park Lane for E. J. Berisford. R. T. Longden, architect, Moorland Road, Burslem.

CONVOY (Ireland).—Additions, &c., to the Manse. J. M'Intyre, architect, Letterkenny.

CORNWALL.—Proposed new Training College for the Cornwall County Council.

COVE (Kincardineshire).—New railway station (£2,000). Mr. Moon, C.E., engineer, Perth.

CROES-FAEN (Llantrisant).—Residence and stabling for Dr. E. W. Davies. Cook & Edwards, architects, Masonic Buildings, Bridgend.

CROY (Nairnshire).—New Public Hall.

DENNY, N.B.—New school at Dennyloanhead (£4,000).

DERBY.—Grocery and provision stores, King Street. Derby Co-operative Society, builders and contractors.

DERRY (Ireland).—Boot factory and warehouse; also shops and houses at Castle Gate Corner for H. M'Keown. P. H. Elliott, architect, Exchange Buildings, Castle Street, Derry.

DUBLIN.—New Drumcondra National Schools (£1,000). Batchelor & Hicks, architects, 86, Merrion Square, Dublin; Farmer Bros., contractors.

New model laundry at Dolphin's Barn for the White Heather Laundry Co. A. Hull & Co., Ringsend Road, Dublin, builders; F. Hayes, 24, Nassau Street, Dublin, architect.

DUNDEE.—Administration block for Managers of Dundee Technical Institute.

Addition to factory for G. and J. Cunningham, Ltd., East Dock Street.

Alterations to shop for W. Thomson & Sons, Reform Street.

DUNFERMLINE.—Additions to factory of R. E. Walker Reid & Co., Albany Works. James Shearer, architect.

Stable and coach house for Matthew Leitch, merchant, Albany Street.

Alteration of premises in Bridge Street for Wm. Erskine, draper.

Alterations at Gillespie U. F. Church.

EDMONDSLEY.—Alterations, &c., at the Council school. County Education Committee's architect, Shire Hall, Durham.

ENNISKILLEN.—New hall for the Enniskillen Devenish Branch Irish National Foresters' Benefit Society. Humphreys, Ltd., Stephen's Green, Dublin, contractors.

ENNISTYMON (Ireland).—Extensions and alterations to Catholic church. A. Scott, M.S.A., architect, Dublin. Torpey & Connolly contractors, Ballyglass, Co. Galway.

EPSOM.—Church (£9,000). Nicholson & Corlette, 2, New Square, Lincoln's Inn, W.C., architects.

EWOOD BRIDGE (Lancs.).—Alterations and extensions to Anderton and Halstead's cotton mills.

GLASGOW.—Church hall at Curdovald. Clerk U.F. Presbytery, Glasgow.

GOLCAR (Leymoor).—Club premises for the Thorp Green Working Men's Club and Institute. Arthur Shaw, architect, Golcar.

GOSPORT.—New Baptist church at Newtown (£2,300).

HARROGATE.—Seventeen houses (Birch Grove). D. Sayner, Harrogate.

HARROW.—Baptist Church (£5,000). McKilliam & Proctor, 83, St. Paul's Churchyard, E.C., architects; Mattock Bros., Wood Green, N., architects.

HENGOED (Glamorgan).—Enlargement of girls' school for the County Council. T. Mansell Franklin, clerk Glamorgan County Council, Westgate Street, Cardiff.

HEXHAM.—New Wesleyan Church. J. Walton Taylor, Newcastle, architect; Thos. Dorin, Hexham, builder.

HUDDERSFIELD (Linthwaite).—Six houses and shop for the Linthwaite Co-operative Society. Lunn & Kaye, architects, Milnsbridge and Huddersfield.

HUNTLY (Aberdeenshire).—Villa for James Murray. T. G. Archibald, architect, Huntly.

KING'S LYNN.—New motor factory. Critchley & Howes, owners.

KIRKCALDY.—Large linoleum works for the Fife Linoleum Co., at Pathead. J. D. Swanston & Syme, architects, Kirkcaldy.

KIRKINTILLOCH.—Extension to printing works of the *Kirkintilloch Herald*.

Masonic temple in Regent Street.

LEIGH (Lancashire).—Proposed completion of St. Thomas's Church (£5,000).

New spinning mill for the Butts Spinning Co. (a new company).

LONDON (Brompton, S.W.).—New County Court and offices.

(Streatham).—New boys' home for the Society of St. Vincent de Paul.

(Wapping, E.).—New police station (£13,500). J. Dixon Butler, F.R.I.B.A., surveyor to the Metropolitan Police.

(W.C.).—Buildings on site of 7, 8 and 9, Norfolk Street, Strand. Dunn, Soman & Coverdale, 11, St. Helen's Place, Bishopsgate Street, E.C., surveyors.

(Stratford, E.).—New church hall, St. Thomas's Church. Rev. H. Brown-Gold, vicar.

(Bucklersbury, E.C.)—Shops and offices. F. G. Minter, Putney, builder.

(Throgmorton Street, E.C.).—Additions and alterations to buildings. Colls & Sons, 5, Coleman Street, E.C., builders.

(Kilburn, N.W.).—Additions and alterations to 60, High Road. Haskins & Co., 20, Old Street, E.C., contractors.

(Mayfair).—Rebuilding 25, Upper Brook Street. Prestige & Co., Pimlico, S.W., builders.

(W.).—Buildings in Dering Street (Oxford Street). C. Gude & Son, Ltd., 177, Dalston Lane, Hackney, N.E., contractors.

(W.).—Additions to Langham Hotel. J. M. Anderson, 6, Stratton Street, W., architect.

(W.C.).—Extensive alterations to Great Queen Street Theatre. Thos. Bush, 54, Ebury Street, S.W., builder.

(Strand).—Rebuilding Yates's Wine Lodge.

(Strand).—Shops, &c. W. H. Lorden & Son, Upper Tooting, builders.

(Mayfair).—Rebuilding 49, 50, Upper Brook Street. Matthews, Rogers & Co., 1, Ground Street, Park Lane, W., agents.

(Mayfair).—Extensive alterations to 2, Park Street. Higgs and Hill, Ltd., Crown Works, South Lambeth Road, S.E., builders.

(Ealing).—Conversion of houses in Uxbridge Road into shop premises. Nichols, 77, Grafton Road, Acton, builder.

(South Tottenham).—Bible Christian Church and Schools in High Road.

(Bloomsbury).—Alterations and additions to L. and S.W. Bank. A. D. Watson, 34, Great St. James Street, W.C., architect.

(Kingsway).—Offices, showrooms, &c. Barlow & Roberts, 15, Red Cross Street, Southwark, builders.

MANCHESTER.—New warehouses, Newton Street and Dale Street. Contractors, Messrs. Burgess & Galt, Ardwick, Manchester.

(Failsworth).—New cotton spinning mills, Mersey and Argyle. Plans passed by the U.D.C.

(Crumpsall Park).—New Wesleyan Church to be built (£4,000 to £4,500).

(Worsley Green).—Eight houses for the Earl of Ellesmere.

MACCLESFIELD.—Post-mortem room in Hawthorne Street. C. W. Stubbs, borough surveyor, Town Hall, Macclesfield.

Laboratory at Macclesfield Sewage Works at Butley. Borough surveyor.

MERTHYR TYDFIL (Penydarren).—Business premises, 293-425, High Street, for W. R. Cohen, Pontmorlais. C. M. Davies, 112, High Street, Merthyr Tydfil.

METHIL (Fife).—Offices at Aberhill for the Wemyss Tramway Co.

MONTROSE.—New convalescent home to cost £2,500. D. Smith, chairman of Infirmary Committee.

MORTLAKE.—Shops in Upper Richmond Road. A. Horsey, owner.

NEWCASTLE-ON-TYNE.—Blocks of dwellings for the T.C. (£7,440). E. Weatherley, builder, Villa Place, Newcastle-on-Tyne.

NORTHAMPTON.—Additions to J. Sears & Co.'s boot factory. A. P. Hawten, builder, Northampton.

NEWPORT (Isle of Wight).—New Church of England schools. P. G. Stone, architect, 33A, Holyrood Street, Newport (I.W.).

OSSETT (Yorks.).—Spinning shed, warehouse and offices. Jonas Glover, Wesley Street, Ossett, owner.

OXFORD.—New Ruskin College (£20,000).

PENRITH.—Observation Ward at Fair Hill Hospital for the U.D.C. J. J. Knewstubb, surveyor, Town Hall, Penrith.

LIVERSEDGE (Hightown).—New Sunday Schools, "St. Barnabas" (£1,000). Howorth & Howorth, architects, Cleckheaton.

PERTH.—Dwelling houses and motor-house at Murray's Royal Asylum. Condie, Mackenzie & Co., agents.

Easter Moncreiffe Mansion extensions. Whytock Bros., builders, Perth.

Infirmary reconstruction to cost £20,000. Mr. Mackay, architect, Perth.

POLLOKSHIELDS, N.B.—New church, St. Gilbert's. Sir John Stirling-Maxwell, trustee.

PONTARDAWE.—New Public Hall and Institute (£1,000).

PONTYPRIDD (Llwynpia).—New Welsh Baptist church and schools. R. S. Griffiths, architect, Tonypandy, Pontypridd.

Business premises for P. Lougher & Son. A. L. Thomas, architect, Church Street Chambers, Pontypridd.

PORT-E-VULLIN (Isle of Man).—Villa residences for J. G. Groves. R. G. Corkhill, builder, Ramsey, Isle of Man.

PORTH (Rhondda).—Two additional wards at the Cottage Hospital. J. Rees, architect, Pentre, Rhondda.

PRESTON (Walton-le-Dale).—Fire station and other buildings for the U.D.C. F. E. Dixon, civil engineer, 49, Lune Street, Preston.

ROCHFORT BRIDGE (Co. Westmeath).—New Deaf and Dumb Institute for the Sisters of Mercy. Anthony Scott, 34, Lower Sackville Street, Dublin, architect; Mr. Lynam, builder, Enniscoffey.

ROTHERHAM.—Workshops for Baker & Co., Ltd., Binsworth Works, Rotherham.

RUABON (Rhos).—New Congregational Church (£1,600). Llewelyn Davies, builder, Rhos.

RUGBY.—Ten houses for the Co-operative Society. Franklin & Newman, architects, Regent Street, Rugby.

SALISBURY.—New ward at the Infirmary, "Harcourt and Maud Coates Ward" (bequest of £20,000).

SCARBOROUGH.—Conversion of "Seacroft" into a large hydro. Plans submitted to the Corporation.

SCUNTHORPE.—New church.

SELKIRK.—New technical school.

SHIPLEY (Yorkshire).—"Woolcombers'" warehouse. James Young & Co., architects, Bradford.

SKELTON-IN-CLEVELAND (Yorks.).—Club premises for the Skelton and District Workmen's Club, Ltd. Secretary, 5, Elliott Street, Skelton-in-Cleveland.

SOUTHPORT.—New Corporation fire station (£1,800). Mr. Hirst, surveyor, Southport.
New schools to be built by the T.C. (£13,500).

STAMFORD.—Martin's Cultivator Co.'s workshops. Mr. J. T. Ward, architect, Stamford.

STANLEY.—Primitive Methodist Manse. W. Forster, architect, Stanley.

SUNDERLAND.—New hospital for children, High Barnes. T. Robinson, secretary, Infirmary Offices, Fawcett Street, Sunderland.

SUTTON-IN-ASHFIELD (Notts.).—Shops in Parliament Street and Victoria Street. S. Pert, owner.

SWANSEA (Cwmavon).—Important additions to Pennel Baptist Church. Evans & Jones, architects, Trinity Place, Swansea.

TIPTON.—Proposed extension to public offices. W. H. Jukes, surveyor, Public Offices, Owen Street, Tipton.

TURRIFF.—New higher grade school. James Duncan & Sons, architects, Turriff.

TYNEMOUTH.—New police station for the T.C. John F. Smillie, borough surveyor, Tynemouth.

VICARSTOWN (Ireland).—Additions, &c., to Vicarstown Catholic Church. Anthony Scott, M.S.A., architect, 34, Lower Sackville Street, Dublin.

WATERFORD.—Premises for the Provincial Bank of Ireland in Barrowstrand Street. Batchelor & Hicks, 86, Merrion Square, Dublin, architects; G. Nolan, Waterford, contractor.

WEDNESBURY (Darlaston).—Important additions to works. F. H. Lloyd and Co., James Bridge, Darlaston, owners.

WEST BRIDGFORD.—Proposed new public offices.

WIDNES.—Important additions to the Alexandra Theatre. Jas. Kiddie, owner.

WOKING.—Detached bungalow residence (Kingfield Green). W. T. Stevens, Woking, owner.

YOKER, N.B.—Engineering works for Drysdale & Co., Ltd., London and Glasgow.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—January 8th, 1908. One common battery switchboard and 3,000 subscribers' telephones (specification No. 166) for the Deputy Postmaster-General, Adelaide. Specifications can be seen at the Commonwealth Office, 72, Victoria Street, S.W.

Austria.—August 31st. The Austrian State Railway authorities at Czernowitz are inviting tenders for the establishment of an electric plant at the railway station in that town, for lighting and power purposes.

Belgium.—August 28th. The Belgian State Railway authorities at La Bourse, Brussels, are inviting tenders for the supply of the material required for the electric lighting of the railway station at Tamines.

Bohemia.—September 14th. The railway authorities at Prague require tenders for electrically-driven tools with motors varying from 5 to 12 H.P.

Bourges.—August 30th. The Artillery Depôt requires tenders for one dynamo and two electromotors.

Bristol.—Converters, switchgear and cables for the T.C. See "Official Notices" August 9th.

Cardiff.—September 14th. The Guardians invite tenders for provision of telephones, necessary wiring, switchboard, &c., and alteration of present telephone service at their Cardiff and Ely Workhouses. A. J. Harris, Clerk, Union Offices, Queen's Chambers, Cardiff.

Clonmel.—September 7th. Electric lighting of the District Lunatic Asylum. Section 1, suction-gas plant, engines and dynamos. Section 2, accumulators, switchgear, mains, wiring and fittings. Section 3, buildings and foundations. See "Official Notices" August 9th.

Croydon.—September 9th. Overhead material for Corporation tramways. See "Official Notices" to-day.

Dartford.—September 4th. Fire alarms and telephones at Gore Farm Hospitals for the Metropolitan Asylums Board. See "Official Notices" to-day.

Dublin.—September 9th. Cables for the Lighting Committee. See "Official Notices" to-day.

Egypt.—November 1st. The Alexandria Harbour authorities require tenders for the construction of an electric power station and for the following plant, to be worked by electric power:—Five transporters of large range; five ditto of smaller range; six cranes of 4 tons each; 36 cranes of 2 tons each; 25 capstans; cables, feeders, &c. Particulars may be obtained from the Directeur des Postes et Phares.

Erith.—September 4th. Overhead mains extension for electricity supply for the U.D.C. See "Official Notices" to-day.

Farnworth (Bolton).—Proposed extension of local electricity works, or putting down of additional machinery. Mr. R. B. Leach, electrical engineer.

Finchley.—August 31st. Surface condensing plant for the U.D.C. electricity works. See "Official Notices" August 16th.

Finchley.—September 16th. Feeders, mains and other cables; network and joint boxes for the U.D.C. See "Official Notices" August 16th.

France.—August 30th. The French Post and Telegraph authorities are inviting tenders for the supply of 220 tons of bimetallic wire, 2 mm. diameter, and 60 tons ditto, 3 mm. diameter. Particulars may be obtained from, and tenders are to be sent to, Le Sous-Secretariat d'Etat des Postes et des Telegraphes, 103, Rue de Grenelle, Paris.

France.—The municipal authorities of Bergerac (department of Dordogne) have invited offers for the concession for the electric lighting of the town during a period of 30 years.

France.—August 30th. The artillery corps at Bougres, Departement du Cher, require tenders for a dynamo and two electric motors.

France.—August 31st. The chief engineer of the maritime service at Dunkerque requires tenders for the electric lighting of the locks and other parts of the port.

France.—September 3rd. The Under-Secretary for Posts and Telegraphs, 103, rue de Grenelle, Paris, requires tenders for electric cables in 12 lots, 5 of which consist in the remaking of old cables. Papers by August 24th.

Llandudno.—September 2nd. Supply and erection of battery, booster, &c., for the pier company. See "Official Notices" August 9th.

Marylebone.—August 27th. Coal (10,000 to 15,000 tons) for the B.C. electricity works for six months. Forms of tender from Town Clerk, Town Hall, Marylebone Lane, W.

New Zealand.—The T.C. of Napier requires tenders for a complete electric lighting, tramway and power installation.

New South Wales.—August 29th. The Newcastle Town Council requires tenders for one combined electric generating set, one switchboard, and other central station equipment.

Oystermouth.—The U.D.C. is inviting applications from those willing to establish an electrical undertaking there. See "Official Notices" August 9th.

Portugal.—September 4th. The Camara Municipal do Concelho de Ovar is inviting tenders for the supply of electric light for the public and private lighting of Ovar. Conditions at once from the Bureau of the Camara Municipal do Concelho, Ovar.—*Board of Trade Journal.*

Queensland.—September 9th. The Deputy Postmaster-General requires tenders for the supply of lead-covered paper-insulated telephone cable, also various post and telegraph stores, telegraph and telephone instruments, parts, &c. Specifications of the above, and of a number of other contracts for telegraph and telephone material, may be inspected at the office of the Electrical Review.

Queensland.—September 30th. The Postmaster-General requires tenders at Brisbane by September 30th for telephones, Leclanché cells, coin attachments, Edison-Lalande cells, resistance coils, battery pole changers, operator sets, &c.

South Africa.—The *British and South African Export Gazette* says that the East London Municipality has instructed its London agents, Messrs. Dyer & Dyer, Ltd., 17, Aldermanbury, E.C., to obtain fresh tenders from British firms for the tramway material required in connection with the extension of the local tramway system.

The Durban Municipality will shortly be in the market for rails and other tramway material. The London agents are Messrs. Webster, Steel & Co., 5, East India Avenue, E.C.

Salford.—Tenders will shortly be invited by the Tramways Committee (Mr. G. W. Holford, general manager) for cars of the single-truck double-deck type, with covers.

Southampton.—The Corporation require sundry underground cables, conduits and earthenware troughs. See "Official Notices" to-day.

Spain.—The municipal authorities of Mollet (province of Barcelona) have invited tenders for the concession for the electric lighting of the town.

Stockport.—August 26th. Automatic point controllers for the T.C. See "Official Notices" August 2nd.

Sweden.—September 15th and October 1st. The General Direction of the Canal and Waterworks at Trolhattan, Sweden, are inviting tenders until September 15th for the supply and erection of turbines of 10,000 H.P.; and until October 1st for three 350-KW. continuous-current dynamos, a 4,800-ampere-hour battery of accumulators, four three-phase alternators of 11,000-kilovolt-ampere capacity, 12 relays, regulators, switchboards, &c.

Swinton and Pendlebury.—September 5th. E.L. wiring for the council offices and public baths at Swinton, and the Town Hall at Pendlebury for the U.D.C. See "Official Notices" to-day.

Victoria.—January 7th, 1908. The Postmaster-General requires tenders at Victoria for 11 sections of a common-battery switchboard and 3,000 subscribers' telephones and other apparatus for the telephone exchange at Windsor.

Worksop.—September 4th. Low-tension cables, joint-boxes, &c., for the U.D.C. See "Official Notices" to-day.

CLOSED.

Bolton.—The Electricity Committee has just accepted a couple of tenders from the British Westinghouse Co., Ltd., for the supply of transformers and switchboards.

Dublin.—The Corporation has accepted tenders as follows:—

Ferranti, Ltd., for sub-station switchboards, £2,668, and feeder panels, £340.
British Electric Transformer Co., for transformers, at £2,320.

The Committee accepted the lowest tender in each case.

Dundee.—Messrs. J. Mackersie & Co., Dundee, have secured the contract for the electrical work in connection with the additions to the central police station. The following have had their offers accepted for the tramway extension:—

Tie-bars.—Bayliss, Jones & Bayliss.
Rails.—Maclellan & Co., Glasgow.
Points & crossings.—Hadfield's Steel Foundry Co.
Electric equipment.—The Forest City Electric Co., the British Insulated and Helsby Cables Co., and the Alloa Iron Co.

Glasgow.—The T.C. has now resolved to accept the tender of Messrs. Richardsons, Westgarth & Co., Ltd., for a 3,000-KW. turbo-alternator set for Pinkston power station.

Hampton.—The U.D.C. has accepted the tender of the Horsfall Destructor Co. for the provision of a refuse destructor.

Huddersfield.—The T.C. has accepted the tender of Messrs. E. Bould & Son, for the installation of the E.L. at the new secondary school for girls at Greenhead Hall.

Manchester.—Messrs. Higginbottom & Mannock, Ltd.' Crown Ironworks, of West Gorton, have received the order for 8 electric passenger elevators, 6 electric goods lifts, and 4 hand hoists for the new Royal Infirmary at present in course of construction in Manchester.

Portsmouth.—The E.L. Committee has accepted the tender of Messrs. Aiton & Co. for the supply of steam, exhaust and water pipes, &c., at £3,004, that of the British Thomson-Houston Co. for a high-tension switchboard, at £850, and that of the British Electric Transformer Co. for 6 transformers, at £66 each.

Salford.—The T.C. has accepted the following tenders:—

W. H. Keys.—Trinidad bitumen and bitumen compound.
Baxendale & Co.—Arc lamp globes.
British Insulated & Helsby Cables, Ltd.—House fuse boxes.
British Westinghouse Co.—Special car accessories.
Edison & Swan United Electric Light Co.—Gravity type ammeters.

St. Albans.—The North Metropolitan Electric Power Supply Co. have placed an order with Messrs. Heenan & Froude, Ltd., for a refuse destructor, to be erected in conjunction with the electric power station they are about to erect for the supply of electrical energy in the city and rural district of St. Albans.

Sunderland.—The T.C. last week accepted the following tenders for work, &c., for Hylton Road station, aggregating £3,377:—

Electric Construction Co., Ltd., for motor and switchgear to drive the pneumatic equipment of the deep well.
Wallis Bros., Sunderland, pipework.
British Westinghouse Electric Co., extra-high-tension switchgear.
White Bros., for wiring to motors and for lighting extensions.
India-rubber, Gutta-percha, and Telegraph Works Co., india-rubber insulated cable for stock.
E. J. Shotton, painting arc lamp-posts.
British Westinghouse Electric Co., three power-factor indicators for three alternators.

A new low tension feeder is to be laid from Messrs. Doxford's western sub-station to the sub-station at Messrs. Short Bros.' shipyard at a cost of £1,150, and the tender of the British Insulated and Helsby Cables, Ltd., for the necessary cables has been accepted. The Albion Clay Co. are to supply the stoneware ducts.

The Electricity Committee has accepted the tenders of Mr. R. Blake and Mr. J. F. Potts for scrap metal.

FORTHCOMING EVENT.

Wednesday, September 4th.—At Sheffield. Annual general meeting of the Institution of Mining Engineers.

THE FRANCO-BRITISH EXHIBITION, 1908.

PARTICULARS of the Franco-British Exhibition of Science, Arts and Industries, which is to be held at Shepherd's Bush next year, are now in circulation. The Council of the Institution of Electrical Engineers has agreed that the Institution shall co-operate in organising the Electrical Engineering Section, of which the President, Dr. R. T. Glazebrook, is the chairman. At present about 100,000 sq. ft. has been allotted for the whole of the eight sections into which the engineering group is divided, and inquiries are now on foot to ascertain the probable space and facilities likely to be required by Electrical Engineering.

We extract the following particulars of the proposed classification of exhibits from the prospectus before us:—

CLASSIFICATION OF EXHIBITS AND ARRANGEMENT OF GROUPS.

Liberal Arts.

Mathematical and scientific instruments.

Engineering and Shipping.

All branches of engineering will be illustrated. Constructional, mechanical, gas, electrical, mining, metallurgical, marine and shipbuilding. Exhibits will include materials of construction, plant and processes; methods of generating power; steam, gas and electrical working of mines and quarries, ores and minerals; methods of manufacturing iron, steel and other metals; steam and gas engines.

Electric motors and utilisation of electricity, telegraphy and telephony; electric and gas lighting; models, plans and drawings relating to docks, harbours and works of construction; to warships and merchant ships; motors, machinery and machine tools. Shipping will include exhibits of the great passenger steamship lines, cargo steamers, cross-channel and coasting steamers, &c.; material and equipment of ships; armament and equipment of warships, including guns, gun mountings, submarine mines, locomotive torpedoes, and special mechanical appliances.

Transportation.

Carriages, wheelwrights' work, motor-cars and cycles; road vehicles; saddlery and harness; railway and tramway plant; inland navigation; aerial navigation.

Decoration and Furnishing.

Apparatus and processes for heating and ventilation; apparatus and methods (not electrical) for lighting.

Various Industries.

India-rubber and gutta-percha industries.

In *L'Electricien* for August 17th we read that the electrical classification is to be identical with that adopted for the Paris Exhibition of 1900, with the additional inclusion of Class 15. It is given thus:—

Group V.—Electricity and Instruments of Precision.

Class 15.—Instruments of Precision.
Class 23.—Production and Mechanical Utilisation of Electricity.
Class 24.—Electrochemistry.
Class 25.—Electric Lighting.
Class 26.—Telegraphy and Telephony.
Class 27.—Various Applications of Electricity.

NOTES.

Chemical Examination of Government Purchases.—In the course of the report of the principal chemist upon the work of the Government laboratory during the year ended March 31st, 1907, reference is made to the examination of samples submitted by Government departments of goods purchased by them. The samples examined for the Post Office included 85 of creosote oil for preserving telegraph posts, and 18 per cent. of these were found unsuitable for the purpose. In addition to these, the department submitted for analysis battery materials and general stores, including zinc, tin, lead, brass, German silver, &c. The India Office also forwarded for examination 137 samples of engine, dynamo, cylinder and other mineral lubricating oils, together with 94 samples of steel, copper, zinc, tin, antimony, aluminium and other metals.

Thomson-Houston v. Westinghouse Controller Patents.—It is stated that the Compagnie Française de Thomson-Houston instituted a patent process last year against the Société Westinghouse, in regard to the alleged imitation of a controller for motors for tramways on the Wight and Potter system. This method, it was contended, was protected by a Swedish patent and by a French patent of July 30th, 1892. The French Courts have now dismissed the action. In the course of the judgment it was held that the patent fees in Sweden had not been paid since October 15th, 1897, and that, therefore, *ipso facto*, the patent became void both in Sweden and in France from that time. On the other hand, the Courts refused to grant the counterclaim made by the Westinghouse Co. for £25,000, as damages for unjust action, but the Thomson-Houston Co. was ordered to pay the whole costs of the proceedings.

Water Power in Switzerland.—An ancient scheme for utilising the water power of the Rhine, near Laufenburg, is now making a little progress, and English names are associated with it. The question goes back to 1891, when the Swiss Compressed Air and Electricity Co., of Berne, applied, through Engineer Trautweiler, for a concession to establish a hydro-electric plant, it being intended to construct a tunnel canal for the water, which would have yielded 5,000 H.P. At the same time a second project, due to the English engineer, Mr. Dierden, was put forward, proposing to dam the Laufen in connection with the rocky chasm below the Rhine rapids. On inquiry the author of the latter scheme is said to have proved to be Mr. Z. de Ferranti, who placed himself in communication with the Felten & Guilleaume Co. on the subject. This particular proposal met with approval, and in 1899 the Compressed Air Co., the Felten & Guilleaume Co., and Mr. Ferranti united forces in the submission of a joint application for a concession on the basis of the Ferranti scheme, which contemplated the utilisation of 26,000 H.P. Since then considerable delay has occurred owing, among other matters, to the fact that the Rhine at the spot concerned belongs half to the Swiss Canton of Aargau and half to the Grand Duchy of Baden. Eventually both these States granted the concession, which bears the date of July 30th, 1906. The formal deeds were handed over on payment of a single sum of £5,700 last December for the concession, on the basis of 4s. per horse-power to be obtained, and it is now proposed to form a company, 16 years from the initiation of the scheme, to carry it into effect.

Electric Shock Fatalities.—On 15th inst. an inquest was held at Newcastle concerning the death of John Allan, aged 43, who lost his life early last week through electric shock. From the evidence of a fellow worker, it appears that Allan was a chargeman in the Bothal Yard Seam at Ashington, and, going to attend an electric pump, found a cable hanging from the roof. Deceased lifted the cable, and immediately shouted. Witness got Allan loosed from the cable, and he fell. Thomas McKie, electrical engineer at the colliery, said that on Monday morning last week the cable was examined by eye. Since the accident he had examined it, and found the insulation damaged. He thought it could only have occurred by the electric current leaking from one core of the three-core cable. The indicator in the power station showed no signs of leakage at the time. The outside covering of the cable was burnt for 1¼ in. Deceased left a widow and seven children.

Industrial Spirit in Manufacturing Works.—The report of the principal chemist upon the work of the Government laboratory during the year ended March 31st, 1907, refers to the production and use of ordinary and industrial methylated spirit for manufacturing purposes. It appears that, out of a total quantity of 2,468,619 gallons of industrial spirit used in the financial year, 10,800 gallons were employed in connection with the manufacture of electric lamp filaments, 2,042 gallons in respect of the making of electric cables, &c., and 13,269 gallons in regard to the output of incandescent gas mantles. The report shows an increase last year of 306,600 gallons in the out-turn of industrial or manufacturing spirit as compared with 1905-6, and of 283,600 gallons as contrasted with 1904-5, the actual figures being 2,445,600 gallons, 2,139,000 gallons and 2,162,000 gallons in the three years respectively. The augmentation is attributed to the altered conditions which came into force on October 1st, 1906, and which allow alcohol intended for use in arts and manufactures (now termed industrial methylated spirits) to be denatured with 5 per cent. of wood naphtha instead of the 10 per cent. formerly required to be added to the ordinary unmineralised methylated spirit used for manufacturing purposes. It is believed that the advantages of the new spirit are fully appreciated by manufacturers, and that the decrease in price as well as the greater purity of this alcohol, in consequence of the new regulations, will lead to its increasing employment in industrial operations in the future.

Masters v. Men.—It has been said that the best guarantee for the preservation of peace is to be always fully prepared for war, and the truth of this saying would appear to have been demonstrated during the past week. Before the great engineering strike some ten years ago there was a lack of co-operation among the employers of the country, who were, therefore, to some extent at the mercy of the powerful organisations of the workmen's trade unions. Matters are, however, different to-day; much as the masters were previously opposed to trade union methods, they were forced to adopt the weapons of trade unionism in order to fight trade unionists on terms of equality. Since the acceptance of the terms of settlement we have had comparative peace in industrial circles, and the prompt action of the Employers' Federation has no doubt this week nipped in the bud the guerrilla tactics of the trade unionists, and so prevented a small strike from developing into one of serious proportions.

In times past when there happened to be a dispute between an employer and a section of his workmen, it was the orthodox practice of the trade union authorities to call out the whole of their members; and attempt, if possible, to bring about a general stoppage of work all over the country. This time the tables have been turned by the Employers' Federation adopting these very tactics. It appears that a small number of caulkers, about 32 in all, struck work at the shipyard of Sir W. G. Armstrong, Whitworth & Co., at Walker-on-Tyne, the cause of the dispute being that certain apprentice platers were employed on work which the strikers considered to be caulker's work.

The fine lines of demarcation which exist between the men employed on ship building may appear to an outsider to be almost ridiculous. Thus, a man may lay plates, but he must not caulk them; another man may drill a hole of a certain size, but beyond that he must not go; another man may lay or erect boards of a certain thickness, but beyond that he is trenching on the trade of the carpenters; one man may run a lead pipe, but must draw the line at running an iron pipe, and it is a nice point as to which trade should be employed to connect an iron and a lead pipe together, and so on.

Now, according to an agreement made between the Boilermakers' Society and the Shipbuilding Employers' Federation in December, 1901, it was agreed that an apprentice could be put upon various classes of work at the discretion of the employer, but that an apprentice was not to belong to any trade society (except for the purpose of benefit), nor to be interfered with by any trade society. The employers' view is that the caulkers, by interfering with the apprentices' work, are breaking the terms of the above agreement, and also by leaving work without first submitting the matter in dispute for settlement by recognised associations in accordance with agreement. The employers, therefore, acting in concert, have posted notices in works throughout the kingdom to the effect that the services of all members of the Boilermakers' Society employed in federated shipyards shall be dispensed with after Saturday, August 24th, unless some settlement is arrived at in the meantime. This notice will affect over 50,000 men.

There is, happily, some prospect of the matter being settled within a few days, and negotiations are at present being carried on with this object.

The version of the Boilermakers' Society is that the employers abolished the old agreement which existed between them, and that no agreement is at present in force. They further state that they tried on four successive days to get the matter amicably settled, but were unsuccessful.

According, however, to the circular dated the 19th inst. from the general secretary of the men's society, he is quite willing to instruct the men to resume work pending an inquiry, if the representatives of Sir W. G. Armstrong, Whitworth & Co. will have the cause of the dispute fully inquired into.

This is where the matter stands at the moment of writing, and it is pretty safe to say that, in view of this, there is little doubt that an amicable settlement will be arrived at shortly, and perhaps it is equally safe to say that in that event the prompt settlement will have been due to the trade unionist tactics of the Employers' Federation.

Extension of the Engineering Departments at University College, London.—We are informed that when the new session opens, on October 1st, the extensions to each of the Engineering Departments at University College will be completed. By the removal of University College School to Hampstead, the south wing of the College buildings, that has hitherto been utilised for that School, is set free for University purposes. The plans for the alteration and adaptation of this wing for University purposes were prepared early in the year, and almost on the very day that the school concluded its work, the builders began operations so as to complete the work in time for the session 1907 8.

The chief features of the extensions are as follows. In the Mechanical Engineering Department, which is under the direction of Prof. J. D. Cormack, a new Hydraulic Laboratory will be provided in the basement, and also additional space for experimental work in Mechanical Engineering during the second and third years. A separate Laboratory will be set aside for research work, thereby leaving the main laboratory entirely free for undergraduate work.

In the Department of Electrical Engineering, which is under the direction of Prof. J. A. Fleming, the present lecture room which faces on Gower Street will be replaced by a large new lecture room with a small demonstration class room adjoining it, which will face South, and be entirely removed from the noise of traffic. The old lecture room will be fitted up as an experimental room for advanced students. The Electrical Engineering Department will also obtain a fine research laboratory with apparatus and preparation rooms adjoining.

The Department of Applied Mathematics under Prof. Karl Pearson, which is immediately above the Electrical Engineering Department, will also receive considerable extensions, thereby setting free the existing accommodation for the work of engineering students, and providing new accommodation for those taking civil and municipal engineering. The extensions to the Department of Applied Mathematics will also provide two special research laboratories, and will afford ample accommodation for the important work being carried on in the Galton Eugenics Laboratory.

This laboratory, which has hitherto been temporarily housed at No. 88, Gower Street, will, from October 1st, continue its work in the College buildings under the direct supervision of Prof. Karl Pearson.

On the second floor extensions will be made to the drawing office, which will make it possible to reserve benches for the sole use of each of the students working therein. By a convenient arrangement a small demonstration class room will lead out of the drawing office, in which special problems can be dealt with for small groups of students in a manner that the accommodation of the past has not made possible.

Adjoining the drawing office will be a large museum of apparatus and diagrams. Many of the leading engineering firms have already presented apparatus for exhibition in this museum.

Hardly less important to the student of engineering is the provision of entirely new accommodation for the Department of Geology. Under the direction of Prof. E. J. Garwood, this department provides special courses, supplemented by practical work, for engineering students. It will now be provided with a handsome museum, a research room, and a lecture room suitably equipped with lantern apparatus.

In addition to these improvements, a large room of 50 × 20 ft. has been set aside for the use of the Students' Engineering Society, of which Sir Alexander Kennedy was the founder. This society organises meetings, with lantern demonstrations, on special topics interesting to engineering students, and also arranges visits to works both at home and abroad.

Among the other new advantages which will accrue to the students in the engineering departments, as well as to other students of the College, are to be mentioned the large gymnasium now available for college purposes, and the athletic ground at Perivale that has recently been purchased by friends of the college for members of the Students' Union Societies.

It may be useful to intending students to add that the fees have been re-arranged under a scheme which provides a composition fee of 120 guineas for the complete three years' course in any one of the branches of mechanical, electrical, municipal or civil engineering, this fee being payable in three instalments of 45, 40 and 35 guineas.

Worcester Polytechnic Institute, U.S.A.—In our issue of July 13th, 1906, p. 79, we gave a description and plan of the new electrical engineering laboratory of the Worcester Polytechnic Institute, U.S.A. This huge laboratory, the contract for the building for which, without equipment, was let for £25,000, is now approaching completion. The main laboratory measures 200 ft. × 55 ft., and has three galleries, making in all a floor area of 19,400 sq. ft., and a volume of about 400,000 cb. ft.; it is thus by far the largest electrical engineering laboratory in the world. It is provided with a power plant of 600 H.P., and equipped with 2,000 lamps and 25 motors, aggregating 350 H.P., in addition to the experimental plant. The latter comprises some 50 generators and motors, from 300 H.P. to 1 H.P., having an aggregate capacity of 2,000 H.P., with 40 transformers, of which one gives 500,000 volts, and two others, of 100-KW. capacity each, give 200,000 volts. Special interest attaches to the exceptionally complete equipment for experimenting with electric railway apparatus; besides a costly testing plant, on which an actual car can be mounted, and the acceleration, power, tractive effort, &c., determined, lines of electric railway are provided, in connection with the local railways, and a complete four-motor bogie car. The equipment as a whole is unique in point of magnitude and completeness.

The Disadvantage of Too Much Specialisation.—"In these days when so much has been said about specialisation and about the necessity for any young man in the technical field to devote himself exclusively to a certain branch, it may be well to accentuate the point that specialisation may be carried too far. The man who becomes too one-sided in his work may be useful to a less extent than he would have been had he, while making a particular study of a special field, devoted some time to broaden his intellect in various ways. The truly great men of this, as well as former ages, are men who have not confined themselves to a small sphere of usefulness. It is true that it will not do to divide one's interests between too many things at a time. Do one thing at a time, and do it well, but do not think that the time has come when general information in regard to all the things that surround us in life is useless simply because it is not possible to become a master of all the arts. Perhaps, on the other hand, there never was a time when the man with a broad view had a greater chance. The specialisation in all lines of industry has limited the opportunities for the development of men of varied experiences, but such men are necessary for the executive positions. There is for this reason a premium on the services of the man who has been able to acquire a general, even if limited, knowledge of the industries, the business and other conditions outside of his own branch; and because such knowledge is becoming more scarce, as the specialisation becomes more systematised, there is all the more reason for not being deluded by the general outcry that a man to be truly successful must be a specialist. To a certain limit the man who is a specialist, and nothing but a specialist, is more successful than his fellow-workers; but this is in the secondary positions, when he is working under the guidance of men who can supplement his lack of general development. When the moment comes that the place of managing the whole concern is to be filled, the specialist is left where he is, because he is filling his present place so exceeding well, and the man who never was thought much of where but one of his many faculties came into play, is promoted to the place where he can give full sway to his general knowledge and his varied interests; and the specialist who in his one-sidedness thinks that he was the person logically fit for the promotion, thinks himself badly ignored and his ability misunderstood; he does not realise that with all our specialisation the 'all around man' still holds his own."—*Machinery*, New York.

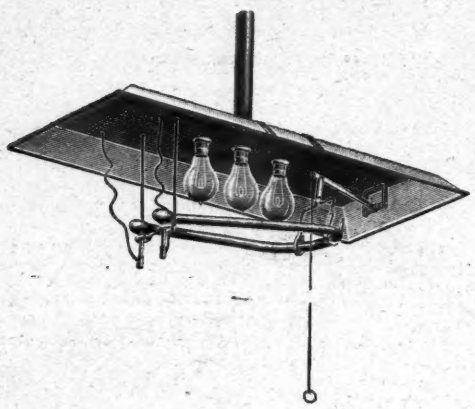
A Portable Pyrometer.—In manufacturing processes and in metallurgical work molten metals and alloys are extensively employed, especially for the making of castings for moulds, and it is of the utmost importance that the metals be mixed, alloyed and poured at the proper temperature in order to obtain the best results. For this purpose the under-described pyrometer is of great utility for every-day shop practice. The complete outfit consists of a portable indicating instrument connected to a special thermo-electric couple, the two electrodes of which are disconnected and left without insulation. When the tips of these elements are slightly immersed into the molten metal, an electric connection is made, and the reading on the instrument will be the same as if the couple had been originally joined. In this manner the tips of the elements assume the temperature of the molten metal almost immediately, the time-lag error being practically eliminated. As the tip becomes worn away, no alteration is made to the reading until the element is finally too short for use and a fresh one has to be inserted. These instruments are being successfully used by a large number of manufacturers, and are made by Mr. W. H. Bristol, 45, Vesey Street, New York City.—*Electrochemical and Metallurgical Industry*, Vol. V., No. 7.

Electrochemical Notes.—The Laszczynski Copper Process.—A description has appeared from the pen of Herr W. Stoeger, of Vienna, in a recent issue of the *Revue de l'Electrochimie* of the Laszczynski process for the electrolytic extraction of copper from its ores, which is being worked at the Miedzianka copper mines in Russian Poland. At the present time the factory is only capable of turning out about 100 kg. of copper per day, a waterfall of 50 H.P. being available, of which only some 15 H.P. is utilised. The ores found in the mine vary in their copper content from 15 to 45 per cent. They are, first of all, roasted to convert them into a mixture of sulphate and oxide. It has been found, however, that the ordinary copper pyrites oven does not act satisfactorily, as it leaves a certain quantity of the copper sulphide unoxidised, and the sulphide is insoluble in the sulphuric acid used in a later stage of the process. The minerals under treatment are, therefore, reduced to powder in suitable mills, mixed with 5 per cent. of clay, and a sufficient quantity of water to render them pasty, and the whole is compressed into briquettes in machines closely resembling those employed by brickmakers. In this manner briquettes are obtained which are so porous that they can easily be dried, become thoroughly oxidised, and give no trouble when being ground again before dissolution in the acid. In order to dry them they are brought into the outer part of the roasting kilns, where they are exposed to the heat of the combustion products from the roasting operation. The briquettes are next roasted until the sulphides are entirely converted into oxides and sulphates. After the roasting process the briquettes are powdered again. The resulting powder is introduced into a wooden vessel and mixed with the electrolyte recovered from a previous operation. This liquid, which contains about 7 per cent. of sulphuric acid, has enough water added to it to replace the quantity lost by evaporation during electrolysis, and to make the whole sufficiently fluid. The solution finally obtained contains about 5 per cent. of copper and 1 per cent. of free sulphuric acid. It is passed through a filter-press in order to remove insoluble matter and run into the electrolytic cells. These cells are composed of lead-lined wooden boxes each containing nine anodes of pure lead covered with a thick layer of cotton cloth (which is the essential feature of the Laszczynski process), and also eight cathodes of pure copper. Between the electrodes wooden agitators are placed and are kept in constant motion during the whole of the electrolysis. Agitation produced by blowing a current of air into the liquid has been found less satisfactory. Current is used at a voltage of between 2·25 and 2·5 per cell. It is stated that the amount of copper deposited is 1·10 grammes per ampere-hour, very nearly the theoretical yield. Each cell contains about 1 cubic metre of liquid, and all but 1 or 1·5 per cent. of the copper contained in it is deposited in 35 or 36 hours. The residual electrolyte is used in the manner already described for the treatment of fresh material, and the cells are filled again until the deposit of copper on the cathodes is 20 or 30 mm. thick, when new cathodes are inserted. It is stated that the copper obtained is almost chemically pure, at least equally pure with the copper manufactured in electrolytic refining works. The Laszczynski process is also used at a place in the territory of Semipalatinsk, in Siberia, where the ore contains only about 5 per cent. of copper. No details are available in the latter case, because, although the process has been patented, the factory has been erected in an uninhabited region 700 kilometres distant from the nearest railway station, in order that certain secret details may not be divulged.

Electrolysis by Alternating Currents.—As a result of an exhaustive study of the corrosion of lead by alternating currents, the following conclusions have been arrived at. For alternating currents the action is by no means as complete or rapid as with direct currents, and the results cannot be determined by any simple formula. The action of one pole does not exactly compensate that of the other as the current is reversed, but there remains over a difference never amounting to more than 0·5 per cent. of the effect produced by a direct current of the same intensity. The electrolytic action of the current varies very considerably with the nature of the electrolyte, nitrates and fertilisers having the greatest corrosive action. As a rule, lead is more readily attacked than iron. In general the conditions met with in the neighbourhood of buried lead-covered cables are such as cause a complete independence of the rate of corrosion and current density, provided that no increase of temperature sets in. As a rule, the corrosion increases as the frequency of the alternation decreases. It is quite impossible to protect cables by embedding them in such substances as concrete, as has been pointed out previously, but good results can be obtained in another manner. By coupling up with a plate of zinc, the lead becomes the negative pole of a local current, and at the same time is almost completely protected from the action of alternating currents, only a small amount of purely chemical corrosion being able to set in.—*Revue d'Eletrochimie et d'Electrometallurgie*, June, 1907.

Appointments Vacant.—Demonstrator (£130), also lecture and laboratory assistant (21s.), for the Heriot-Watt College, Edinburgh; teacher of motor engineering for Woolwich Polytechnic; three shift assistants (£104), also premium pupil at Accrington.

New Bastian Lamp.—We recently had an opportunity of inspecting, at the works of "Sineplat, Ltd.," the latest form of the Bastian mercury vapour lamp, which is incidentally referred to in an article elsewhere in this issue. The accompanying illustration, which came to hand after our other pages were made up, shows its construction. This lamp takes about 500 watts at 200 or 220 volts, and the lamp tube is about 28 in. long, so that the light-emitting surface is of large area. In former types the incandescent lamps were connected in parallel with the mercury vapour lamp, thus increasing the current required; in this case, however, after the lamp has been started on a small external resistance, the latter is



Bastian Mercury-Vapour Lamp.

cut out and replaced by the glow lamps, so that their use does not lower the efficiency of the combination. The lamp starts up instantly, when the cord is pulled to tilt the tube. The light is remarkably free from shadows, and effectively lights a large area, the candle-power, so far as it is practicable to measure it, being greater than that of an arc lamp of equivalent watts, while no trimming or other attention is required during its life. The quality of the light, with the glow lamps in circuit, is very nearly white, the ghastly effects of the pure mercury vapour lamp being absent. The large room in the same building in which the manufacture of the Sineplat leading-in wires (for which large orders are already in hand) is carried on, is illuminated with six of the earlier type of Bastian lamp, with excellent effect.

British Association Report on Electrical Standards.—The following letter came to hand too late for inclusion in our "Correspondence" columns:—

"In Appendix I to the above report, published in your last number (p. 255), I am credited with having submitted for testing at the National Physical Laboratory some Weston cadmium cells made according to the provisional specification issued by that Institution two years ago. The report should have stated that these cells were sent from the Central Technical College, and were set up by Mr. J. A. Sadd, A.C G.I., Honorary Demonstrator in the Electrical Engineering Department.

"London, *August 21st.*

"T. Mather."

Experiments on Wind-Power.—Although, for any purpose requiring a more or less continuous supply of power, the wind is a wholly unsuitable source of energy, there are nevertheless many cases in which it can be utilised with advantage. Even if it has to be supplemented by a stand-by such as an oil engine, and worked in conjunction with a storage battery (which is generally an indispensable adjunct), wind-power may prove a source of economy. A few results derived from a series of experiments which has been carried on for some years by the Danish Government may therefore be of interest; it will be recalled that we published an article by Dr. Gradenwitz on the subject in our issue of December 16th, 1904, p. 973, in which the valuable results of the earlier experiments were described.

The velocities of the wind which are practically utilisable lie between 4 and 16 m. per second, and the motor must be so constructed as to adapt itself automatically to all conditions, including storms. It has been found that a motor with only four wings is the best, and that if the surface of the wings in square metres is s, the velocity of the wind v in metres per second, and the output in horse-power is w, then $w = 1{\cdot}25\ s\ v^3$. Thus for a surface of 12 m^2., with velocities of 4, 6, 8 and 10 m./sec., the power available is 0·625, 2, 5 and 10 H.P. At the experimental station of Askow, with a petrol-motor as stand-by and a storage battery, an installation of 450 glow lamps has been successfully run for two years, at a fair profit even after allowing for interest and sinking fund charges on a 25-year basis. We are indebted to the *Revue Industrielle* for these particulars.

Institution and Lecture Notes.—Association of Engineers-in-Charge.—Mr. W. H. Patchell, M.Inst.C.E., M.I.Mech.E., and M.I.E.E., is the president-elect of this Association, and he will deliver his address on November 13th.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The staff of the Yorkshire Electric Power Co. have presented Mr. Richard L. Johnston, assistant station superintendent, with a handsome case of cutlery on the occasion of his marriage.

The employés at the Wallasey U.D.C. electricity works on August 15th presented a photograph of himself and the staff, and a gold and pearl breast pin, to Mr. J. A. Crowther, engineer and manager, as a token of esteem.

Mr. C. D. Greenhalgh, chief engineer at Wakefield, has been appointed to the post of working assistant at Malvern. Mr. C. S. Anscomb, of the Cleveland and Durham power station at Bishop Auckland, has been appointed as shift engineer in place of Mr. W. Burge, who is leaving Wakefield to join the staff of Messrs. Reyrolle & Co., of Hebburn-on-Tyne.

Tramway Officials.—The officials and employés of the Nottingham Corporation Tramways held a smoking concert at the Poultry Hotel on 15th inst., at which chief motor inspector Mr. W. Griffiths, who is leaving the city, was presented with a memento of his seven years' service. The gift took the form of a gold watch subscribed for by the officials and employés, and a gold and diamond brooch for Mrs. Griffiths, also a gold chain and medallion subscribed for by the inspectors and office staff, and lastly a framed photograph of himself and a few friends, given by a fellow workman. The general manager, Mr. Aldworth, wrote expressing regret at his inability to attend, and paid the guest of the evening a high tribute. The respective presentations were made by Mr. Boot, Mr. Morley, and Mr. Husbands. Mr. Griffiths suitably acknowledged.

General.—We are informed that Messrs. Thos. L. Miller and Adrian Collins, practising in London at 61, Old Broad Street, under the style of Miller & Collins, have dissolved partnership. Messrs. T. L. Miller & Wilson, consulting engineers, of 1, Crosshall Street, Liverpool, and 19, Brazennose Street, Manchester, have taken into partnership Mr. Henry Villiers Pegg, A.M.Inst.C.E., and have opened an office at 47-48, Scottish Temperance Insurance Buildings, Donegal Square, Belfast. They will in future practise under the style of T. L. Miller, Wilson and Pegg.

We read in the *Morning Advertiser* that Mr. T. W. Stratford-Andrews, managing director of the Indo-European Telegraph Co., has been presented by the Tsar of Russia with a gold cigarette case, with the Imperial initials set in jewels, in recognition of services rendered to the Russian Government in connection with the telegraph service between this country and South Russia.

Obituary.—Rev. John Kerr.—The *Times* records the death of Rev. John Kerr, F.R.S., who retired five years ago from the position, which he had held for 44 years, of lecturer on mathematics in the Glasgow Training College of the United Free Church. "He was a devoted student of natural science, especially those branches of the subject known as electro-optics and magneto-optics, and, besides communications to different meetings of the British Association, he was the author of scientific papers of exceptional merit written between 1875 and 1894. In 1898 Dr. Kerr received the gold medal of the Royal Society as the author of important experimental researches in the optical relations of electricity and magnetism." He was 83 years of age.

Sir David Evans, whose death occurred last week, was a director of Callender's Cable and Construction Co., Ltd.

We regret to record the death of Mr. Joseph Kincaid, of Kincaid, Waller, Manville & Dawson, consulting engineers, of Westminster, which occurred on 20th inst. Mr Kincaid was in his 73rd year.

NEW COMPANIES REGISTERED.

L'Estrange & Hay, Ltd. (94,529).—This company was registered on August 9th, with a capital of £10,000 in £1 shares (5,000 preference), to take over the business of a consulting engineer, electrician, dealer in and repairer of and instructor in the use and management of motors of all kinds, and proprietor of motor garage, carried on by A. H. C. L'Estrange at 7, Arundel Street, Strand, W.C., 21, Bride Lane, E.C., and the Mews at 142, Dorset Road, Clapham Road, S.W., and to adopt an agreement with the said vendor. The first subscribers (each with one share) are:—Erroll, Peer, Slains Castle, Aberdeenshire; A. L'Estrange, The Clock House, Arundel Street, Strand, W.C.; S. Hay, Slains Castle, Aberdeenshire, consulting engineer; Major W. G. Phibbs, 25, Parkside, Knightsbridge, S.W.; C. Bent, 115, Mellison Road, Tooting, S.W., motor engineer; W. P. Smith, 23, Benedict Road, Brixton, S.W., motor engineer; and P. C. Atkins, 81, Cannon Street, E.C., solicitor. No initial public issue. The first directors are A. H. C. L'Estrange and Lieut. the Hon. S. M. A. J. Hay (permanent managing directors, special qualification £2,500 of the shares allotted to them). Qualification of ordinary directors 250 shares; remuneration of A. H. C. L'Estrange £300 per annum and 10 per cent. of the surplus net profits remaining after 6 per cent. dividend has been paid on the preference shares; of Lieut. the Hon. S. M. A. J. Hay £150 per annum and 5 per cent. of the surplus net profits remaining after such 6 per cent. is paid. Registered office, The Clock House, Arundel Street, W.C.

G. A. Steinthal and Boydell, Ltd. (94,610).—This company was registered on August 16th, with a capital of £5,000 in £1 shares (2,000 6 per cent. cumulative preference), to acquire the business of electrical engineers and contractors carried on by W. P. Steinthal, at 41, Piccadilly, Bradford, and at 1B, Cooper Street, Manchester, as "G. A. Steinthal," and to carry on the same and the business of suppliers of electricity and electric, magnetic, galvanic and other apparatus, &c. The first subscribers (each with one share) are:—W. P. Steinthal, 41, Piccadilly, Bradford, electrical engineer; H. M. Boydell, Hale, Chester, electrical engineer; J. H. Boydell, 83, Market Street, Manchester, merchant tailor; W. R. Clarke, 26, Brown Street, Manchester, chartered accountant; E. F. Steinthal, 53, Whitworth Street, Manchester, merchant; F. Zimmern, 53, Whitworth Street, Manchester, merchant; and E. Leonard, 21, Keppel Road, Chorlton-cum-Hardy, electrical engineer. No initial public issue. The number of directors is not to be less than three or more than seven: the first are W. P. Steinthal and H. M. Steinthal (managing directors) and J. H. Boydell. W. P. Steinthal is chairman; qualification, £.00 shares or stock; remuneration (except managing directors) as fixed by the company.

S. H. Heywood & Co., Ltd. (94,580).—This company was registered on August 13th, with a capital of £12,000 in £1 shares, to acquire the business of mechanical, electrical and hydraulic engineers carried on by S. H. Heywood and H. W. Heywood at 37A, Fountain Street, Manchester, and at the Standard Works, Reddish, Lancs., as "S. H. Heywood," and to carry on the same and the business of electricians, suppliers of electricity for light, heat, motive-power or otherwise, manufacturers of electrical apparatus, &c. The first subscribers (each with one share) are:—H. W. Heywood, 8, Union Street, Stretford, engineer; S. H. Heywood, 5, Stanley Mount, Brooklands, Manchester, engineer; Mrs. B. E. Heywood, 8, Union Street, Stretford; Mrs. E. Heywood, 5, Stanley Mount, Brooklands, Manchester; T. Valentine, 17, Church Road, Clevedon, Manchester, cashier; J. H. Ashworth, 171, Coal Clough Lane, Burnley, chartered accountant; H. S. Campbell, 14, Brockenhurst Street, Burnley, accountant. No initial public issue. The number of directors is not to be less than two or more than five; the first are S. H. Heywood and H. W. Heywood; qualification, £100; remuneration as fixed by the company. Registered office, Standard Works, Reddish, Lancs.

Spagnoletti, Ltd. (94,447).—This company was registered on August 1st, with a capital of £20,000 in £1 shares, to acquire the business of an electrical and mechanical engineer and manufacturer, carried on by J. E. Spagnoletti, at Goldhawk Works, Goldhawk Road, Shepherd's Bush, W., as J. E. Spagnoletti & Co., to adopt an agreement between J. E. Spagnoletti, of the first part, H. M. Bayly of the second part, J. Lawrence of the third part, G. J. L. Nicholson of the fourth part, and W. E. Harrington of the fifth part, whereby the said J. E. Spagnoletti agrees to sell the said business to W. E. Harrington, and to carry on the business of mechanical, mining and general engineers, builders, electricians, dealers in oils, generators, accumulators and suppliers of electricity for light, heat and power, &c. The first subscribers (each with one share) are:—J. E. Spagnoletti, Goldhawk Works, Goldhawk Road, Shepherd's Bush, W., engineer; H. M. Bayly, 20, Addison Road, Bedford Park, W., electrical engineer; G. J. Lothian Nicholson, Albany Chambers, York Street, Westminster, electrical engineer; W. S. Fire, 14, Roxwell Road, Shepherd's Bush, W., clerk; W. E. Harrington, 107, Coningham Road, Shepherd's Bush, W., clerk; E. J. Snelling, 25, Dudley Gardens, West Ealing, W.; and F. E. Joyce, 5, Nicosia Road, Wandsworth Common, S.W., electrical engineer. No initial public issue. The number of directors is not to be more than seven; the first are J. E. Spagnoletti (permanent; special qualification, 5,000 shares); H. M. Bayly; J. Lawrence; and G. J. L. Nicholson; qualification of ordinary directors, £100 shares or stock; remuneration (in addition to any salaries specified in said agreement) £100 each per annum, payable out of the surplus profits after 7 per cent. dividend is paid on the ordinary shares, and a further £50 each, payable out of any surplus after 10 per cent. is paid on such shares. Registered office, Goldhawk Works, Goldhawk Road, Shepherd's Bush, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Birmingham Electrical Case Co., Ltd.—A mortgage dated July 26th, 1907, to secure £125, and as collateral security thereto, a debenture of even date, for securing the same sum, charged on the company's undertaking and property, present and future, including uncalled capital, have been registered. Holders: W. O. Field, Downing Street, Smethwick; and W. L. Field, Birch Street, Langley, Worcestershire (trustees of the Smethwick Mutual Aid Permanent Money Society).

Hendon Electric Supply Co., Ltd.—A trust deed dated July 30th, 1907, to secure £25,000 (with power to issue further stock, the present instrument being stamped to cover £25,000) has been registered. Property charged: The company's undertaking and property, present and future, including uncalled capital. Trustees: Beaver Trust, Ltd., 1, Queen Victoria Street, E.C.

Jetley, Ltd. (electrical engineers, London), (94,362).—A trust deed dated August 2nd, 1907, to secure £4,000 debentures created by resolution of even date, has been registered. Property charged (by debentures): The company's undertaking and property, present and future, including uncalled and unpaid capital. By trust deed: The leasehold hereditament, 8, North Audley Street, W. Trustees: J. M. Henderson, Moorgate Street Buildings, E.C.

Ilfracombe Electric Light and Power Co., Ltd. (71,378).—This company's annual return was filed on July 3rd, when 67 shares had been taken up out of a nominal capital of £15,000 in £5 shares. £5 per share has been called up, resulting in the receipt of £335. Mortgages and charges: Nil.

Gorseinon Electric Light Co., Ltd. (39,944).—This company's annual return was filed on June 12th, when the entire capital of £1,000 in £1 shares had been taken up. £1 per share has been called up, resulting in the receipt of £990 10s. £9 10s. remains in arrears. Mortgages and charges: £800.

Brompton and Kensington Electricity Supply Co., Ltd. (25,913).—This company's annual return was filed on June 26th, when 30,131 ordinary and 9,869 preference shares had been taken up out of a nominal capital of £300,000 in £5 shares (20,000 preference). £5 per share has been called up on 29,131 ordinary, and 9,869 preference, resulting in the receipt of £195,000. £5,000 is considered as paid on 1,000 ordinary. Mortgages and charges: Nil.

Walter's Electrical Manufacturing Co., Ltd. (London) (94,300).—£2,000 5 per cent. debentures, created and dated July 31st, 1907, charged on the company's property, present and future, including uncalled capital, have been registered. No trustees.

James & Browne, Ltd. (electricians, London) (72,372).—Issue on July 20th of £100 5 per cent. debentures, part of series created June 29th, 1906, to secure £6,000, charged on the company's undertaking and property, present and future, including uncalled capital. Trustees: J. W. Ellis, Portland House, Basinghall Street, E.C.; and E. Hughes, 106, Holland Road, Kensington. Previously issued of same series: £4,850.

Holman James & Co., Ltd. (electricians, Maidenhead) (83,604).—£1,200 5 per cent. debentures, created July 29th and dated July 31st, 1907, charged on the company's undertaking and property, present and future, including uncalled capital, have been registered. No trustees.

Lewes and District Electric Supply Co., Ltd. (64,333).—This company's annual return was filed on June 17th, when 2,327 ordinary shares had been taken up out of a nominal capital of £50,000 in 2,500 ordinary and 2,500 preference shares of £10; £23,270 has been received. Mortgages and charges: Nil.

Loughborough and District Electric Traction Syndicate, Ltd. (64,144).—This company's annual return was filed on June 24th, when the entire capital of £1,000 in 100 shares of £10 each had been taken up and paid for in full. Mortgages and charges: Nil.

County of Northampton Electric Power and Traction Co., Ltd. (65,747).—This company's annual return was filed on July 9th, when the entire capital of £25,000 in 2,500 shares of £10 each had been taken up; £9 12s. per share had been called up and £24,000 had been received. Mortgages and charges: Nil.

Lowne Electric Clock and Appliances Co., Ltd. (Catford).—Particulars of £1,000 debentures created by resolution of May 13th, 1907, have been filed pursuant to Sec. 14 (4) of the Companies' Act, 1900. Property charged: the company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

Electrical Companies in 1906.

A TABULAR return has recently been issued as a Parliamentary paper in relation to the joint stock companies registered during the calendar year 1906, the particulars being given, as far as possible, from the latest returns made by the companies. The first part of the return deals with companies registered which filed a prospectus, and to which certificates to commence business have been granted. It may be summarised as follows:—

Companies Registered in England.	Nominal share capital.	Amount allotted before commencing business.
Cleveland & Durham Electric Power, Ltd.	£1,000,000	£415,854
Delhi Electric Tramways & Lighting Co.	170,000	100,000
Electric Sweetmeats, Ltd.	20,000	500
"Harper" Electric Piano Co.	11,000	5,000
Llandudno & District Electric Tramway Construction Co.	100,000	77,900
London Electrobus Co.	305,000	50,119
Ludlow Electric Light Co.	8,000	1,040
Madras Electric Supply Corporation	400,000	5,000
Mansfield & District Tramways	130,000	6,000
Rhondda Tramways Construction Syndicate	250,000	248,100
Simplex Conduits, Ltd.	100,000	40,000
Companies Registered in Scotland.		
Caledonia Motive Power Supply Co.	100,000	12,500
Motive Power Supply Co.	10,000	4,501
Peebles Motor Co.	10,000	3,230

The third part of the return represents a list of the companies which were registered during 1906, and which filed a declaration that the company "does not issue any invitation to the public to subscribe for its shares."

The companies which were registered during the year, and which have not filed a prospectus or a declaration in regard to inviting the public to subscribe for shares, are referred to in the fourth part of the return. These undertakings include the Bettws-y-coed Electric Lighting Co., the Electrical Manufacturers' & Wholesale Traders' Protection Association, the Formby & Freshfield Electric Light Co., Lytham Electric Light & Power Co., Rymney Valley and General Electric Supply Co., Telegraphone, Ltd., and the Ystradgynlais Electric Lighting Co., all of which are London registrations. The fifth part of the return deals with the companies which were dissolved or struck off the register during the year ended December 31st, 1906.

Particulars of all new electrical companies, and also of those struck off the register, have appeared in the ELECTRICAL REVIEW during the period dealt with.

According to figures published in the *Investors' Guardian*, the English registrations of electrical, engineering, gas, rubber, railways and tramways, and motor undertakings, for the past three half-years have been as follows:—

	Jan.-June, 1905.	Jan.-June, 1906.	Jan.-June, 1907.
Electric	£3,206,425	£2,088,055	£1,431,030
Engineering and hardware	4,952,807	3,426,536	3,992,285
Gas	311,480	508,000	597,900
Motor, cycle, 'bus and car	2,802,032	6,567,130	4,691,191
Railways and tramways	8,372,000	2,790,575	1,464,832
Rubber	—	2,590,750	1,847,800

Official Announcements re Companies.—The following companies are to be struck off the register within three months unless cause is shown to the contrary:—

Auto Steam Generator Syndicate, Ltd.
Bridge Accumulator Syndicate, Ltd.
Burnand Transformer Co., Ltd.
Crown Electric Heating Syndicate, Ltd.
Finchley Electric Light Co., Ltd.
Folkestone District Electric Light and Power Co., Ltd.
Medical Electro Vibration Institute, Ltd.
Paddington Electric Supply Co., Ltd.
Rand Electric Syndicate, Ltd.
Rapid Transit Co., Ltd.
Thames Electric and Motor Boats, Ltd.
Vaughan Brown & Co., Ltd.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended July 26th, 1907, were 632,582, compared with 574,479 in the corresponding four weeks of 1906.

MARKET QUOTATIONS.

Wednesday, August 21st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	per cwt.	22/-	..
a ,, Oxalic	per cwt.	38/-	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal)	per ton	£33 10	..
a ,, ,,	per ton	£30	..
a Bleaching powder	per ton	£5 10	..
a Bisulphide of Carbon	per ton	£18	..
a Borax	per ton	£15	..
a Copper Sulphate	per ton	£29	..
a Lead, Nitrate	per ton	£34	..
a ,, White Sugar	per ton	£35	..
a ,, Peroxide	per ton	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£30	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	per lb.	9d.	..
a Potassium Cyanide	per lb.	7½d.	..
a Shellac	per cwt.	220/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	per ton	£6 10	..
a ,, Recovered	per ton	£5 10	..
a ,, Lump	per ton	£5	..
a Soda, Caustic (white 70 %)	per ton	£10 15	..
a ,, Chlorate	per lb.	3½d.	½d. inc.
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a ,, Cyanide (basis 100 %)	per lb.	7d.	..

METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£150	£50 dec.
b ,, Wire, in ton lots	per ton	£177	£43 dec.
b ,, Sheet, in ton lots	per ton	£163	£47 dec.
p Babbitt's metal ingots	per ton	£60 to £195	..
c Brass (rolled metal 2" to 12") basis	per lb.	8⅞d.	1d. dec.
c ,, Tube (brazed)	per lb.	11d.	¼d. inc.
c ,, ,, (solid drawn)	per lb.	9¼d.	¼d. inc.
c ,, Wire, basis	per lb.	8⅝d.	1⅛d. dec.
c Copper Tubes (brazed)	per lb.	1/0⅜	¼d. dec.
c ,, ,, (solid drawn)	per lb.	11⅞	¼d. dec.
g Copper Bars (best selected)	per ton	£105	..
g Copper Sheet	per ton	£105	..
g ,, Rod	per ton	£105	..
e ,, (Electrolytic) Bars	per ton	£88	£8 dec.
e ,, ,, Sheets	per ton	£96	£8 dec.
e ,, ,, Rod	per ton	£91	£10 dec.
e ,, ,, H.C. Wire	per lb.	10¾d.	1¼d. dec.
Ebonite Rod	per lb.	3/8	..
f ,, Sheet	per lb.	3/-	..
f German Silver Wire	per lb.	1/7½	½d. dec.
h Gutta-percha, fine	per lb.	5/6 to 6/6	..
h India-rubber, Para fine	per lb.	4/9½	..
i Iron, Charcoal Sheets	per ton	£18	..
i ,, Pig (Cleveland warrants)	per ton	57/-	1/- inc.
i ,, Forgings, according to size	per ton	From £11	..
i ,, Scrap, heavy	per ton	47/6 to 50/-	..
i ,, Wire, galvanised No. 8	per ton	£9 15	..
g Lead, English Ingot	per ton	£20	..
g ,, ,, Sheet	per ton	£20 5	2/6 inc.
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£6 16 to £7	..
d Mica (in original cases) small	per lb.	6d. to 1/-	..
d ,, ,, ,, medium	per lb.	3/6 to 4/-	..
d ,, ,, ,, large	per lb.	4/6 to 8/6	..
p Phosphor Bronze, plain castings	per lb.	1/4½ to 1/6½	..
p ,, rolled bars & rods	per lb.	1/5½ to 1/6½	..
p ,, ,, strip & sheet	per lb.	1/6 to 1/10	..
o Platinum	per oz.	110/-	..
e Silicium Bronze Wire	per lb.	1/8½	..
Steel, Magnet, acc'd'g to desc'p'n	per ton	£58	..
,, ,, in bars		£15 to £40	..
g Tin, Block (English)	per ton	£169 to £170	£7 10 dec.
n ,, Wire, Nos. 1 to 16	per lb.	2/3	½d. dec.
p White Anti-friction Metals— "White Ant" brand	per ton	£56 to £80	..
b Zinc, Sh's (Vieille Montagne bnd.)	per ton	£28	10/- dec.

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, G.P. and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.

Fairbairn, Lawson, Combe Barbour, Ltd.—The directors have declared an interim dividend on the ordinary shares for the six months ended June 30th at the rate of 5 per cent. per annum.

Stock Exchange Notices.—The Committee has ordered the undermentioned securities to be quoted in the Official List:—

National Telephone Co., Ltd.—Further issue of £616,425 deferred stock.

Applications have been made to the Committee to appoint a special settling day in, and to grant a quotation to:—

Kepitigalla Rubber Estates, Ltd.—Further issue of 5,500 vendors' shares of £1 each, fully paid, Nos. 219,501 to 225,000.

United River Plate Telephone Co., Ltd.—£300,000 4½ per cent. mortgage debenture stock.

STOCKS AND SHARES.

Tuesday Afternoon.

Business in the Stock Exchange is very quiet, but the condition of affairs financial is the reverse of pleasant. No sooner has one cloud dissipated before another comes blacker than the last. Added to the all-round anxiety produced by the long decline in prices, there has been a fresh outbreak of labour agitation, which, for a while, assumed a threatening aspect, and drove certain of the well-known industrial shares steadily downward.

There is good hope, however, of the situation at the Armstrong and the Vickers works being amicably resolved, but the incident underlines the growing uneasiness at the development of workmen's demands. Chairmen at the recent half-yearly meetings of the great trunk railway companies have referred to the matter in no uncertain tones, declaring that the undertakings will be governed by the directors and not by the staffs. Labour has assumed a prominence never before recognised in the joint-stock world, and whatever theoretical views may be held as regards Socialism, this latter-day product of civilisation is a bear point for markets, and a sore trial to proprietors of many industrial shares.

Home Railways are still struggling with adversity, and the fear of a general strike and lock-out in the North of England spread dulness over prices of stocks either side of the Tweed. The London group is, of course, not much affected, except by sympathy, and the electrical stocks keep their prices, allowing for the *ex* dividend quotations. Central London concessions in the matter of through bookings with the latest Tube were discussed as having more direct bearing upon profits in the future than in the present, and the falling away of the traffic receipts is an evidence justifying this view. Great Northern and City Preferred "A" shares have fallen to 35s. upon the drop in the dividend from the hitherto guaranteed 4s. per share to the post-guarantee distribution of 11½d. District stock hardened to 12 upon the cheerful speech of Sir George Gibb at the company's meeting, but the strength was not maintained, and the price came back to 11. Metropolitan Consolidated at 38 continues very dull. Underground Electric Notes are 2 points lower on the week.

Amongst the manufacturing shares there is no present indication of labour troubles affecting electrical concerns. Babcock & Wilcox are steady, while Willans & Robinson Preference have moved up to 4, which is ½ rise. Callender's Preference are the same fraction easier, and Telegraph Construction Debenture bonds are ½ up, movements that cannot be connected by any stretch of imagination with employment differences.

Supply shares maintain their normal dead level of quietude and inertness. London Electrics are flat, both Preference and Ordinary falling ¼ each. The Brompton shares are *ex* dividend; so are Charing Cross Ordinary and Preference and Westminster Ordinary, the changes in prices practically reflecting the deductions. Edmundson's Preference declined again as soon as a small demand was satisfied. The new issues which are eager to appear dare not do so in the present state of financial depression. It was only last week that an offer of Debenture stock in a new railway company was withdrawn, and the few subscriptions returned, on account of the meagre response afforded by the public to the issue.

Quiet sales of Anglo-Argentine Trams are still being made, and the price is again ⅛ lower at 8¼. British Electric Traction Preference at 6⅞ are *ex* 6s. dividend. There have been buyers about of Potteries Preference at 12s. 6d., also *ex* dividend. Metropolitan Electric Tramways Preference have hardened to 18s. 9d., and the company is said to be doing very well.

A slight decline in Eastern Telegraph stock leaves the price at 135½, and the Preference is 2 lower at 87, and Extension shares fell to 13. Anglo-American Telegraph stocks shaded off during one of the many slumps in American Rails. Direct United States Cable shares gave way ⅜ to 14¼. The market complains that it is because the price is too listless to keep up. Cuba Telegraphs are also easier at 8.

National Telephone issues have received a little support, the effect of which is seen in small advances in the second Preference shares and the 3½ per cent. Debenture stock.

South Metropolitan Electric Light and Power Co., Ltd.—The transfer register of 7 per cent. cumulative preference shares is closed from August 18th to 31st for the preparation of dividend warrants payable on 31st inst.

Ascot District Gas and Electricity Co.—The accounts for the half-year ended June 30th show a profit of £2,581. An interim dividend at the rate of 5½ per cent. per annum is recommended, carrying forward £931.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1903.	1904.	1905.	1906.	Closing Quotations Aug. 13th.	Closing Quotations Aug. 20th.	Business done week ended Aug. 20th, 1907. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3 — 3½	3 — 3½	..	..	..	Nil
149,600	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	Nil	5 %	5 %	85 — 88	85 — 88	..	..	..	5 13 8
660,860	Anglo-American Telegraph	Stock	6½.	2¾%	3½%	3⅞%	60 — 63	60 — 63	..	..	..	6 3 0
3,169,670	Do. do. do. 6 % Pref.	Stock	6 %	5⅛%	6 %	6 %	105⅜—106⅜	105½—106½	106⅜	105½	— ½	5 12 8
3,169,670	Do. do. do. Deferred	Stock	2s.	Nil	¼%	1⅜%	16⅜— 17¼	16½— 17	17⅛	16¼	— ¼	9 14 5
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	..	5 %	5 %	101 —104	101 —104	..	..	..	4 16 2
44,000	Chili Telephone, Nos. 1 to 44,000	5	7 %	8 %	8 %	8 %	6⅞— 7⅛ xd	7 — 7⅛	..	..	+ ⅛	5 10 4
2,097,680	Commercial Cable Sting. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	92 — 94	92 — 94	93½	..	..	4 5 1
16,000	Cuba Telegraph	10	0 %	5 %	5 %	5 %	7⅜— 8⅜	7 — 8	..	..	— ¼	6 5 0
6,000	Do. 10 % Pref.	10	15 %	10 %	10 %	10 %	15⅜— 16⅜	15⅜— 16⅜	15½	15⅜	..	5 19 5
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3⅜— 3⅝	3⅜— 3⅝	..	..	..	5 8 6
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	9 — 9½	9 — 9¼	..	..	..	5 5 3
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	98 —101 xd	98 —101	..	..	..	4 9 1
60,710	Direct United States Cable	20	3 %	3½%	4½%	4⅝%	15½— 15⅝	14⅝— 15½ and bonus	14⅝	14⅛	— ⅛	3 12 6
57,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99½—101½	99½—101½	..	..	..	4 8 8
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	134 —139	133 —138	136½	132⅝	—1	5 1 5
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	83 — 90	86 — 88	89	86¼	—2	3 19 7
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	103 —105	103 —105	..	..	..	3 16 2
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	13 — 13½	12⅝— 13¼	13⅛	12⅞	— ⅛	5 5 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104 xd	102 —104 xd	..	..	..	3 16 11
295,400	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	4 %	97⅜—100⅜	97⅜—100⅛ xd	..	..	..	3 19 7
200,000	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	98⅛—100⅛	98⅛—100⅛	..	..	..	3 19 7
181,127	Globe Telegraph and Trust	10	5⅛%	5⅛%	5⅛%	5⅛%	10⅛— 11	10⅛— 11	10⅛	10⅛	..	5 0 0
181,127	Do. do. 6 % Pref..	10	6 %	6 %	6 %	6 %	13¼— 14	13¼— 14	13⅝	13½	..	4 5 9
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	15 %	24 %	24%	20 %	34 — 36	34 — 36	35½	..	..	5 11 1
28,900	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99½—101½	99½—101½	..	..	..	4 8 8
17,000	Indo-European Telegraph	25	10 %	18 %	18 %	13 %	56 — 58	56 — 58	..	..	..	5 12 1
$41,380,400	Mackay Companies Common	$100	..	15%	2 %	33⅓%	66 — 68	66 — 68	..	..	..	5 2 11
$50,000,000	Do. do. 4% Cum. Pref.	$100	..	4 %	4 %	4 %	67 — 69	67 — 69	..	..	..	5 15 11
256,127	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅜— ⅜	⅜— ⅜	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	3 %	4 %	5 %	..	1⅛— 1 1/16	1⅛— 1 1/16	..	..	..	4 14 1
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	..	¾— 1	¾— 1	..	..	..	5 0 0
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106 —108	106 —108	107	106½	..	5 11 1
2,225,000	Do. do. Def. Stock	100	5 %	5 %	5 %	5⅛%	105 —107	105 —107 xd	105⅞	105 5/16	..	4 13 6
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	11 — 13	11 — 13 xd	..	..	..	4 12 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	5 %	9½— 11½	10 — 12	11	10⅜	+ ½	4 6 11
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 5/16— 5 7/16	5 5/16— 5 7/16 xd	5⅛	..	..	4 10 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	95⅝— 97⅝	96 — 98	96⅞	..	+ ⅛	3 1 6
1,689,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100½—102½	100½—102½	101⅛	..	..	3 11 5
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	6½%	6½%	7 %	7 %	1⅜— 1⅝	1⅜— 1⅝	..	..	..	5 1 10
50,000	Do. do. do. 6 % Cum. Pref.. ..	1	6 %	6 %	6 %	6 %	1 5/16— 1 7/16	1 5/16— 1 7/16	..	..	..	4 11 5
100,000	Do. do. do. 4 % Red. Deb. Stock ..	100	..	..	4 %	4 %	91 — 94	91 — 94	..	..	..	4 5 1
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
11,839	Reuter's	8	5 %	5 %	5 %	5 %	7 — 8	7 — 8	..	..	..	5 0 0
60,000	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	..	4½%	4½%	98 —101	98 —101	..	..	..	4 10 0
3,167	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	127 —130	127 —130	..	..	..	4 13 4
80,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅞— 7⅛ xd	6⅞— 7⅛ xd	..	..	..	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 11
15,609	West African Telegraph, Shares	10	4 %	4½%	4 %	4 %	10 — 10⅛	10 — 10⅛	..	..	..	3 16 2
30,008	W. Coast of America, 1 to 30,000 & 53,061 to 53,008	2	Nil	Nil	Nil	2½%	1⅛— 1⅜	1⅛— 1⅜	..	..	..	3 12 9
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	97 —100	97 —100	97⅞	97½	..	3 18 5
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	7 %	13 — 13½	13 — 13½	..	..	..	5 3 8
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..	3 17 8
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	3/16— 5/16	3/16— 5/16	..	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	7 %†	6 %	5 %	8 %	⅞— 1	⅞— 1	⅞	..	..	10 5 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	Nil	6⅜— 7⅜	6⅜— 7⅜	..	..	..	Nil
0,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	99 —102	99 —102	..	..	..	4 18 0

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

270,000	Anglo-Argentine Trams, Nos. 260,008 to 510,007, and 560,008 to 580,007	5	..	8 %	8 %	8 %	8½— 8¾	8¼— 8⅜	8⅝	8¼	— ⅛	4 10 2
260,007	Do. 5½ % Cum. Prefs., 1 to 260,007 ..	5	5½%	5½%	5½%	5½%	6 — 6½	6 — 6½	6⅝	..	..	4 8 0
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	131 —134	131 —134	131½	131	..	4 9 7
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 5
880,000	Babcock & Wilcox, 1 to 530,000..	1	17 %	20 %	20 %	20 %	3⅝— 4	3½— 4	78/9	77/6	..	5 0 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅛— 1⅜	1⅛— 1⅜	..	..	..	3 7 7
88,000	British Aluminium, Ord., 2,001 to 40,000	5	..	7 %	7 %	7 %	4⅜— 5⅛	4⅜— 5⅛	5	..	..	7 0 0
40,000	Do. do. 7 % Cum. Pref.	5	Nil	7 %	7 %	7 %	5 — 5⅜	5 — 5⅜	5⅜	..	..	6 7 3
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	6 %	6 %	6 %	4⅜— 5⅛	4⅜— 5⅛	..	..	..	5 14 3
20,000	Do. do. 4 % Funding Certs.	5	..	4 %	4 %	4 %	3⅞— 4⅛	3⅞— 4⅛	..	..	..	4 14 1
258,000	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	100 —103	100 —103	..	..	..	4 17 1
300,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	..	5½%	96 — 99	96 — 99 xd	97½	..	..	5 11 1
400,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	6 %	6 %	127 —132	127 —134	..	..	..	4 10 11
300,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	110 —114	110 —114	..	..	..	4 7 9
300,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	103 —106	103 —106	104	..	..	4 14 4
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250 ..	40	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
183,301	British Electric Traction	10	6 %	6 %	3 %	Nil	2⅜— 2⅞	2⅜— 2⅞	48/9	47/6	..	Nil
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	6 %	6⅛— 7⅜	6½— 7⅜ xd	7⅜	..	..	8 5 6
1,448,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	100—103	100 - 103	101½	100	..	4 17 1
410,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	4½%	4½%	4½%	78 — 81	78 — 81	80	..	..	5 11 1
100,000	British Insulated and Helsby Cables	5	8 %	8 %	8 %	10 %	6⅞— 7⅛	6⅞— 7⅛	..	..	..	6 17 11
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5⅝— 6⅛	5⅝— 6⅛ xd	..	..	..	4 18 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
212,000	British Thomson-Houston 4½ % 1st Mort. Debs.	100	4½%	4½%	4½%	4½%	87 — 91	87 — 91	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	6 %	Nil	Nil	..	1 — 1⅛	1 — 1⅛	23/9	23/3	..	Nil
1,016,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	59 — 64	59 — 64	..	..	..	6 5 0
50,000	‡Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	⅝— 1⅛	⅝— 1⅛	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	2½%	Nil	¼— ⅜	¼— ⅜	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	Nil	⅜— 1⅛	⅜— 1⅛	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	88 — 91	88 — 91	..	..	..	4 18 11
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	71 — 74	71 — 74	..	..	..	6 1 7
100,000	Buenos Ayres & Belgrano, 1 to 100,000 ..	5	3 %	4 %	3 %	3 %	4⅛— 4⅜	4⅛ — 4⅜	85 3	84/-	..	3 8 7
40,000	Do. do. "A" 6 % Cum. Pref., 1 to 40,000	5	6 %	6 %	6 %	6 %	4⅜— 5⅛	4⅜— 5⅛	98/9	..	..	5 14 3
27,500	Do. do. "B" do., 1 to 27,500	5	6 %	6 %	6 %	6 %	4⅜— 5⅛	4⅜— 5⅛	..	..	..	5 14 3
13,200	Do. do. 5 % Deb. Stock	100	5 %	5 %	5 %	5 %	105 —115	105 —115	..	..	..	4 6 11
190,000	Do. do. 5 % 2nd Deb. Stock	100	5 %	5 %	5 %	5 %	100 —103	100 —103	..	..	..	4 17 1
137,610	Calcutta Trams, 1 to 137,610	5	6 %	8 %	8 %	8 %	7⅛— 8	7⅛— 8	7⅞	..	..	5 0 0
30,000	Do. 5 % Cum. Pref., Nos. 1 to 29,330..	5	..	..	5 %	5 %	5⅛— 5⅝	5⅛— 5⅝	..	..	..	4 8 11
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	102 —106	102 —106	..	..	..	4 4 11
35,000	Callender's Cable Construction shares	5	12½%	12½%	15 %	15 %	9⅜— 10⅜	9⅜— 10⅜	10⅜	..	..	7 0 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5½— 5⅝	..	..	..	4 6 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105¾—107¼	106 —108	..	..	+ ¼	4 3 4
491,222	Cape E Trams., 1 to 491,222	1	10 %	8 %	Nil	..	1/16— 1/16	1/16— 1/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	4 %	6 %	8 %	1⅛— 1 1/16	1⅛— 1 1/16	24/6	..	..	6 1 11
224,988	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	95 —100	95 —100 xd	..	..	..	4 8 8
911,568	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %	73 — 76	71 — 73 xd	72½	..	..	5 9 7
544,216	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	91 — 93	89 — 91 xd	80	..	..	4 7 11
544,216	Do. do. Def. do.	Stock	4 %	4 %	4 %	4 %	53 — 56	53 — 56	..	..	..	7 2 10
1,480,000	City and South London Railway	Stock	2¾%	2½%	1½%	2½%	45 — 47	44 — 46 xd	46¾	44½	..	4 12 2
85,000	Crompton & Co., Nos. 1 to 85,000	3	2½%	2½%	2½%	5 %	1⅝— 1⅞	1⅝ — 2⅛	41/10½	41/-	..	6 17 11
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	94 — 97	94 — 97	..	..	..	5 3 1

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

(Continued on next page.)

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1903.	1904.	1905.	1906.	Closing Quotations Aug. 13th.	Closing Quotations Aug. 20th.	Business done week ended Aug. 20th, 1907. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	..	10 %	10 %	..	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	6 3 1
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	..	1 — 1¼	1 — 1¼	..	..	..	4 16 0
294,150	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 1 to 60,000	10	5⅛%	6 %	6%	6 %	13¾ — 14¼ xd	13¾ — 14¼ xd	..	..	..	4 4 3
59,987	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	12⅝ — 13⅜	12⅝ — 13⅜ xd	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	N	2½%	4⅛%	..	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	9 1 10
17,139	Do. "A" shares, 01—017,139	5	N	2½%	4⅛%	..	2⅛ — 2⅜	2⅛ — 2⅜	..	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	83 — 85	83 — 85	..	..	..	4 14 2
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	89 — 92	89 — 92	..	..	..	5 8 8
112,100	Electric Contruction, 1 to 112,100	2	4 %	Nil	Nil	Nil	3/16 — 7/16	3/16 — 7/16	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	Nil	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	Nil
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	4 %	5 %	5 %	5 %	8 — 8½	8 — 8⅝	..	..	..	5 17 8
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	92 — 95	92 — 95	..	..	..	5 16 8
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	3 %	4 %	4 %	4 %	1⅞ — 2⅛	1⅛ — 2 xd	..	..	..	20 0 0
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10⅜ — 10⅝	10½ — 10¾	..	..	..	6 18 4
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103	..	..	..	4 17 1
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15%	15 %	11½ — 12⅛	11½ — 12⅛	12⅛	11⅞	..	6 0 0
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	5⅛	..	..	8 17 3
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105⅛ —107⅛	105⅛ —107⅛	..	..	..	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	5 %	10%	10 %	14½ — 15½	14½ — 15½	..	..	..	6 9 0
37,500	†Liverpool Overhead Railway, Ord.	10	1¾%	1¼%	Nil	Nil	1⅝ — 2	1⅝ — 2	..	..	..	Nil
10,000	† Do. do. Pref., £10 paid	10	5 %	5 %	5 %	5 %	7 — 8	6⅞ — 7⅞	8⅛	..	— ⅛	6 7 0
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	6 %	3 %	3 %	6¼ — 7⅛	6⅛ — 7⅛	..	..	..	8 8 7
399,930	Do. do. 60,008 to 100,000	10	8 %	6 %	3 %	3 %	6⅝ — 7⅛	6⅛ — 7⅛	..	..	..	5 2 2
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5 %	7⅞ — 8⅜ xd	7⅞ — 8⅜	..	..	..	5 14 3
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	84 — 88	84 — 88	..	..	..	4 10 11
314,016	Metropolitan Electric Trams., Defd.	1	Nil	Nil	Nil	Nil	3/32 — 5/32	3/32 — 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	13/32 — 15/32	29/32 — 31/32	..	..	+ 1/32	5 2 7
350,000	Do. do. 4½ % Deb. Stock Red.	100	..	4½%	4½%	4½%	94 — 97 xd	94 — 97	..	..	..	4 10 11
30,000	Peebles (B.) & Co., 6 % Cum. Pref., 20,001 to 50,000	5	..	6 %	6 %	6 %	3¾ — 4	3¾ — 4	..	..	..	7 10 0
245,500	Potteries E. Trc.	1	5 %	5 %	4 %	4 %	9/16 — 11/16	7/16 — 9/16	..	..	..	6 8 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	13/16 — 15/16	⅝ — ¾ xd	..	..	..	6 13 4
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
37,350	Telegraph Construction and Maintenance	12	20 %	15 %	15 %	15 %	31 — 33	31 — 33 xd	32¼	32⅜	..	5 9 1
150,000	Do. 4 % Ded. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	99 —102	99¼—102½	99¾	..	+ ½	8 18 1
599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	..	5 %	5 %	5 %	64 — 67	62 — 65	..	..	—2	7 13 10
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	3 %	Nil	Nil	..	1⅛ — 1⅜	1⅛ — 1⅜	25/-	..	..	Nil
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	6 %	Nil	Nil	..	3½ — 4⅛	3¾ — 4¼	88/9	82/6	+ ⅛	Nil
246,574	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	76 — 80	76 — 80	..	..	..	5 0 0

ELECTRICITY SUPPLY COMPANIES.

14,000	Bromley (Kent) E.L. & P,. 1 to 14,000	5	5 %	5⅓%	5⅓%	5⅓%	4⅞ — 5⅛	4⅞ — 5⅛	..	..	..	5 4 9
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	98 —100	98 —100	..	..	..	4 10 0
29,798	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10 %	10%	7⅞ — 8⅜	7⅛ — 8⅜ xd	..	..	..	5 17 8
10,202	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7⅛ — 7⅜	7⅜ — 8⅜ xd	..	..	..	3 18 10
336,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	8 %	8 %	5 %	5 %	3⅝ — 4	3⅝ — 3¾ xd	75/-	..	..	6 9 0
80,000	Do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	3⅞ — 4⅛	3⅝ — 4⅛ xd	..	..	..	4 17 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾ — 3⅞	3¾ — 3⅞	70/-	66/3	..	6 0 0
427,400	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
49,436	Chelsea Electricity Supply, Ord.	5	5⅓%	6 %	6 %	4⅝%	3¼ — 4⅛	3¼ — 4⅛	..	..	..	5 0 0
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 5 9
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	5 %	6 %	6 %	6 %	9 — 10	9 — 10	9 7/8	9 5/16	..	6 0 0
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	10⅜ — 11⅝	10⅜ — 11⅝	10⅝	..	..	5 2 2
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	121⅛	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	99	..	..	4 10 11
40,000	County of Durham Electrical Power, Ord.	5	4 %	£3 7 0	4 %	4 %	4½ — 5	4½ — 5	..	..	..	4 0 0
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	4½ — 5	4½ — 5	..	..	..	5 0 0
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4½%	5 %	5 %	7 — 8	7 — 8	7¼	7¼	..	6 5 0
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10½ — 11½	10½ — 11½	..	..	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	106 —109	106 —109	107	..	..	4 2 7
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	94 — 97	94 — 97	..	..	..	4 12 9
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	7 %	4 %	Nil	⅞ — 1	⅞ — 1	..	..	..	11 0 0
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	3 %	1½ — 2¼	1½ — 2	..	..	— ¼	7 10 0
350,000	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	76 — 81	76 — 81	..	..	..	5 11 1
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅞ — 5⅜	4⅞ — 5⅜	..	..	..	5 8 5
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	..	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 15 8
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
13,000	Hove, 1 to 13,000	5	8½%	8½%	9 %	9 %	6⅞ — 7¼	6⅞ — 7¼	..	..	..	6 4 2
21,000	Kensington and Knightsbridge Electric Ord.	5	12½	12 %	10 %	10 %	8½ — 9¼	8½ — 9¼	..	..	..	5 8 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	96 — 99	94 — 97	..	..	..	4 2 6
111,000	London Electric Supply Corporation, Limited, Ord.	3	Nil	3 %	4 %	4 %	1⅜ — 2⅛	1⅜ — 1⅞	..	..	— ⅛	6 5 0
70,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	6 %	4⅞ — 5⅛	4⅞ — 5	95/-	..	— ⅛	6 0 0
374,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4½%	94 — 96	93 — 96	93	..	..	4 13 9
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8½%	10 %	10 %	8 %	5⅛ — 6⅛	5⅛ — 6⅛	..	..	..	6 3 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	4 5 9
220,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	103 —107	103 —107	..	..	..	4 4 1
250,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	87 — 92	87 — 92	..	..	..	8 16 1
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
67,991	Newcastle-on-Tyne	5	8 %	8 %	8 %	8 %	6⅞ — 7	6¼ — 7	..	..	..	5 14 3
75,000	Do. 5 % Pref., 1 to 75,000	5	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 11
10,852	Notting Hill Electric Lighting	10	6 %	7 %	7½%	7½%	11 — 12	11 — 12	..	..	..	6 5 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	6½%	7 %	7 %	7 %	5⅞ — 6⅛	5⅞ — 6⅛	..	..	..	5 9 11
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 97	95 — 97	..	..	..	4 2 6
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	14½%	12½%	10 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	5 14 3
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	4 14 11
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3 %	3½%	86 — 91	86 — 91	..	..	..	3 16 11
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	4 %	Nil	⅞ — 1⅛	⅞ — 1⅛	..	..	..	Nil
50,000	Do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	71 — 75	71 — 75	..	..	..	5 6 8
65,000	South London Electricity Supply, Ord.	5	3 %	4 %	3 %	3 %	2 — 2⅛	2 — 2⅛	..	..	..	6 0 0
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	Nil	2½%	2½%	⅜ — ⅝	⅜ — ⅝	..	..	..	3 6 8
117,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	5 1 10
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	2 — 2⅛	2 — 2⅛	..	..	..	11 2 0
80,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	2 — 3	2 — 3	55/-	..	..	8 6 8
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	..	4½%	4½%	4½%	94 — 97	94 — 97	..	..	..	4 12 9
110,000	Westminster Electric Supply, Ord.	5	12½%	14 %	13 %	12 %	9 — 10	8¾ — 9⅜ xd	..	..	..	8 5 6
81,279	Do. do. 4½ % Cum. Pref. (Original 5 %—Red. to 4½ % from 31st Dec., 1905)	5	5 %	5 %	5 %	4½%	5 — 5⅛	5 — 5⅛	5⅞	..	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 4 per cent., April 25th, 1907.

THE BRITISH ASSOCIATION MEETING AT LEICESTER.

Developments in Electric Incandescent Lamps.

By Leon Gaster.

(Section G.—Abstract.)

It is my object in this paper to give a short review of some of the most important improvements which came before my notice during this year.

I will start with the improvements of the carbon filament, and bring before your notice the metallised, or as it is also called, the graphitised carbon filament, by the aid of which lamps are made consuming on an average 2·5 watts per candle, with a useful life of about 600 hours. The earlier lamps were made for candle-powers from 50 candles upwards, but the lamps exhibited to-day are of 16 c.p., consuming only 40 watts. The lamps are manufactured for voltages varying between 100 and 130. They are sold under the name of the "Gem" lamp, and are now being manufactured in this country at Rugby.

Passing on to the Nernst lamp, a recent improvement consists in fitting the lamps with a newly designed cut-out coil of high resistance, and it is claimed that by the use of this coil a great reduction of the premature failures of filaments will be secured. Several improvements remain still to be made in order that the lamp may light up as soon as the switch is turned on. As regards the efficiency of the lamp, no very great further improvement has yet been secured.

Coming now to the metal filament lamps proper, I will refer first to the Osmium lamp, as produced by Dr. Auer von Welsbach. Owing to the expensive nature of the metal used, and partly to the difficulty in manufacture, and bearing in mind the improvements which have since been made by the same inventor, by the use of tungsten, its use is now likely to be restricted to comparatively low voltages.

The tantalum lamp is only made for voltages up to 125; the high-voltage lamp has not as yet been perfected or brought into the market. The next most important metal used in the manufacture of filaments, and with which much is expected to be accomplished, is certainly tungsten (wolfram). Several methods have been devised for preparing filaments by the use of this metal. One of the first methods was worked out by Dr. H. Kuzel, of Vienna. By his process the metal is obtained in the colloidal state by means of an arc under water. The resulting paste of extremely fine metal is squirted into filaments, which are afterwards heated in order to make them better conductors. The lamps are manufactured in Vienna by Kremenetsky. From such tests as have been made it is ascertained that the lamps consume a little over 1 watt per c.p., with a useful life of about 1,000 hours, with a loss of only 10 to 15 per cent. of the initial c.p.

Another method of manufacturing tungsten filament is the joint invention of Dr. Alexander Just and Franz Hanaman, of Vienna. According to their process a carbon filament is electrically raised to a high temperature in an atmosphere of gaseous tungsten or molybdenum compounds. The carbon then becomes coated with metal, and after burning out the carbon, the filament appears quite homogeneous even under the microscope. By another method the metallic powder is prepared by chemical means mixed with an agglutinant, and squirted into the form of filaments, which are then freed from carbon as before. Various other processes have been devised for preparing a paste of the oxide of tungsten, which can be squirted in filaments and afterwards reduced. According to the British Patent 4,814 of 1907, Messrs. Siemens & Halske have devised a process of stamping tungsten powder, sometimes mixed with another metallic powder, but without an agglutinant, in a tube of some metal, which is easily drawn or rolled, such as tantalum or iron. Then, after electrically sealing the ends, they subject the tube to drawing or rolling processes. After the completion of the drawing process the outer skin can, if desired, be removed. This method obviates the necessity for the great care and treatment involved in the ordinary fusing process, but I have not heard whether the method is actually in use. The diameter of some of these metal filaments is very small, lying between 0·05 mm. and 0·03 mm. A filament yielding 60 c.p. at 110 volts requires to be over 600 mm. long. Experiments which attempt the manufacture of filaments of smaller diameters, such as permit the production of lamps of 110 volts and of about 20 c.p., are in progress, and some lamps of such small c.p. and even of high voltages have already been made on a laboratory scale, some of which I am showing here to-day being made in this country at the Robertson Lamp Works in London. The average life of these tungsten lamps for the present can be reckoned to lie between 600 and 700 hours; some lamps have been burning over 2,000 hours.

The next lamp using tungsten, and which is already used commercially, is the "Osram" lamp, and it is the invention also of Dr. Auer von Welsbach. The lamps are for the present manufactured by the Deutsche Gasglühlicht Gesellschaft, and are imported by the General Electric Co., who, I understand, have decided to begin the manufacture of the same in this country. The lamps are made in various sizes up to 100 c.p., and for varying voltages, but the common type which is expected to be used in the near future will be intended for voltages lying between 100 and 130, and of 35, 50, and 100 c.p. The lamps burn with an efficiency of 1·2 watts per c.p., having a useful life, on an average, of over 600 hours. The candle-power is well maintained over the whole useful life of the lamp. The lamps are recommended to be burnt for the present with the filament in a vertical plane, and can be equally well used on direc or alternating-current circuits.

The Berlin A.E.G. Co. are also manufacturing a type of tungsten lamp, the process for the manufacture of which has not been divulged, but I am able, through the kindness of their English branch, to show you some of the lamps. They are made for various voltages; the lamp shown yields 50 Hefner c.p. at 100 volts. Turning now to the Zircon-Wolfram lamp, to which I have already referred on more than one occasion, I should like to draw attention to some of the improvements which have been made during the last few months, which certainly represent a great advance over the lamps previously exhibited. You will see, for the first time, I believe, metal filament lamps of voltages above 100, which burn satisfactorily in any position. The filaments are mounted on spring hooks made out of tungstenised carbon, the hooks having the effect of maintaining the filament rigid and in shape, whilst in service, and of preventing the loops from touching, also of allowing of a greater number of filaments in the bulb, and consequently, of reducing their length and that of the lamp. On account of the elasticity of the spring hooks, the breakage of filaments in transit and in service has been reduced.

Another improvement over the old type of lamp is the adoption of electrical soldering of the filament to the leading-in wires, thus doing away with the inconveniences caused by the use of graphite paste, which was a partial cause of the blackening, the giving off gases, and the defective contacts met with in the previous lamps. The improvement avoids much extra labour, and also the danger of oxidation of the filament, if the paste is not very carefully burned away. The electrical soldering process takes place in the open, and an experienced operator can carry out the soldering of about 500 lamps daily. The firm of La Carriere in Paris are the inventors of this spring hook, and I understand that the filaments can now be mechanically mounted in such a manner that the operators do not have to touch them with their fingers, thus reducing the number of breakages in mounting the filaments. The latest type of 110-volt contain only four filaments, of 0·025 mm. diameter, giving out 24 Hefner candles, or for 220-volt 48-candles necessitating only the use of eight filaments. Lamps can also be made of 150 to 200 c.p. to compete with small arc lamps for shop and street lighting. The progress made in this country with the use of this lamp has not been great, but arrangements have been made for a factory to be established in London for the manufacture of filaments, and the subsequent sale to lamp-makers. I may mention that the Zircon-Wolfram lamp was the first metal filament lamp of 200 volts, which I had the privilege of showing in this country, early this year, when discussing Mr. Swinburne's paper at the Institution of Electrical Engineers. To-day I will show you some 200-volt 46 c.p. 46-watt lamps.

Before closing with the series of lamps using tungsten, I should like to show you a Helion lamp, of which very little information is as yet available, although unauthorised extraordinary statements were made regarding the efficiency and performance of this lamp. I think I am the first to have the privilege of showing the lamp in this country, having obtained it from the conjoint inventors, Prof. Parker, of Columbia University, and Mr. Clark, during my recent visit last April and May to the States. The lamp looks like an ordinary carbon incandescent lamp mounted in the same-sized bulb; it is a 100-volt lamp, consuming 35 watts, and gives out 30 c.p. I have had the privilege of seeing, at Prof. Parker's laboratory, the manufacture of the filament, for which silicon is reduced from a gaseous form in combination which carbonaceous gases on the surface of a high-resistance carbon core. The inventors claim that this lamp operates at a high temperature without the carbon and silicon uniting to form carborundum as might be supposed. The silicon shows no tendency to become molten or fluid at the temperature attained. The filament starts with a negative temperature coefficient less than carbon, but at about a red heat the coefficient changes distinctly to positive, and remains so as the temperature is further increased. The efficiency of the lamp is claimed to be 1·2 to 1 watt per candle, or it can run at even less. Although a useful life between 600 and 1,000 hours is claimed, a proper series of life tests could not be made, as there seems to be a difficulty in keeping the joints between the filament and the leading-in wires in good condition. For the proper working of the lamp, it is essential that mercury vapour pumps must be used for obtaining the vacuum, and great care must be taken in selecting the carbon core, so as to obtain homogeneity and purity, otherwise the results are considerably affected. Experiments are now being conducted by the inventors, using as a core the graphitised (metallised) carbon filament, but I have not as yet heard with what results. The inventors are also experimenting with a special cement for making the joints, and I hear that the results are promising. One of the characteristic features of the lamp is that the length of the filament need not be increased over the ordinary carbon lamp. The filament is very pliable, and there will be no difficulty (when the present defects, which are chiefly of a mechanical character, have been overcome) in making lamps of low and high voltages and of reasonable candle-power. The lamp easily stands transport, and will be just as safe to handle as the ordinary carbon filament lamp of to-day. This is rather an important point, because one of the troubles common to all metal filament lamps at present is their liability to breakage in transport and in handling, particularly so at the hands of the uninitiated consumer. The advantage to be derived from the use of metal filament lamps may often be more than counterbalanced by the expenditure for renewals of lamps, on account of the breakage of the filament.

Iridium has also been used for the manufacture of lamp filaments. According to Gulcher's process, amorphous iridium is made up into a paste by the aid of an organic binding material. The filaments

are squeezed from this paste, and are made to glow in the air, and not in a receiver containing air under diminished pressure or indifferent gases. The lamp is only produced for low voltages up to 24, and consumes between 1 and 1·5 watts per candle. Other metals, like vanadium, niobium, molybdenum, &c., may also be used in the future, but not much has been made public as yet regarding their use for filaments.

During a visit which I paid to Mr. W. T. Hammer, of New York, I was fortunate enough to see amongst other lamps a few samples of Mr. Heany's invention, some using, I am given to understand, titanium for the filament, and others using a metallic alloy of tungsten and titanium in a dense, shining, coherent state. See U.S. patents No. 839,585 and 842,546. I am given to understand that more will be heard about this lamp shortly.

The economy which can be derived from the use of these new metal filament lamps depends on the price at which the lamps can be sold, the rate of charge for the current used, and the useful life of the lamp, and this is a matter which one must not overlook when tempted to adopt these new lamps for the sake of economy only. The breakage in transport and in handling by dusting or fixing the lamps is a very serious drawback, and to mitigate this evil the lamp-makers will have to work out an arrangement with the consumer so as to reduce the expense to a minimum. The price of the lamp of 100 volts, 50 c.p., is 4s., but there is no doubt that this high price, with an increased output and growing demand, will be greatly reduced in the near future.

Although we have seen that the metal filament lamps can be made of relatively small candle-power at voltages above 100, and of high voltage up to 240, I am given to understand that it is not the intention of most of the manufacturers to sell for the present other lamps than those of high candle-power above 30 c.p., and intended for voltages varying between 100 and 130. This decision has a distinct commercial value, making the change from the carbon filament to the use of metal filaments gradual, so as to be properly appreciated and beneficial to the consumer, manufacturers, and energy suppliers alike. The fact that the high candle-power lamps consume only about one-third or even less energy than generally the present carbon lamps, will, to a very large extent, meet the complaints of the consumer, who, in adopting the lamps, will obtain increased illumination at the same or less energy expenditure than hitherto. It is well known that the carbon incandescent lamps are at present in many cases fixed in a low position, often in the direct angle of vision, and, therefore, detrimental to sight. The reason may be that, on account of the expense at which energy is supplied to the consumer, he could not well afford to enclose the lamps in properly diffusing globes, or to remove them a good distance away from the objects he wishes to be illuminated. With the advent of the new metal filament lamps of relatively high candle-power, the lamp could easily be removed to above the level of the eyes, or enclosed in properly diffusing globes. We should thus obtain good illumination without additional increase of expenditure. I believe, personally, that the high efficiency lamp will prove of inestimable benefit to the consumer, manufacturer and supplier alike. It will bring the electric light within reach of many who have so far hesitated to adopt it, and will render it a cheap and convenient method of lighting. The change from carbon to metal filament must be made gradually. With the extensive use of electricity for lighting purposes, the present suppliers of electric energy will, no doubt, benefit in the long run from the change. For those circuits where high voltage is used, and where it is advisable to introduce the metal filament, resort must be had to series wiring, which, as a whole, is not quite satisfactory, because, as soon as one of the lamps breaks, all the lamps in the circuit go out, and it is not so easy for the ordinary consumer to detect the broken lamp. Several devices have now been introduced to mitigate this drawback. Mr. Dowsing is showing here two of his devices for this purpose. There are also specially devised cut-outs, which act automatically as soon as the lamps break. Where alternating current is used, the voltage can easily be brought down to suit the voltage of the lamps, or auto-transformers similar to those used with arc lamps adopted. In many places on the Continent it has even been found advisable, on account of the charges for current being high, to put down motor-generators to reduce the voltage, instead of re-wiring the existing installation.

Speaking generally of the impressions which I received during my recent visit to America, I should like to inform the meeting that very great progress has been made in the recognition of illuminating engineering as a distinct branch of specialisation in the engineering profession. I observed an extensive use of successful combinations of shades, lamps and lamp-holders by the aid of which combination the best and most efficient illumination is obtained. The Holophane shades and reflectors seem to be very much used, enabling us to direct the light where it is most wanted, and to produce any desired effect of illumination. I think that this combination of lamp, lamp-holder and reflector forming one suitable unit, is worthy of the careful consideration of the lamp-makers in this country.

Having dealt briefly with the improvements made with incandescent metal filaments for general illumination, I should like to draw attention to the progress made in the use of vacuum tubes, and in particular I wish to refer to the Moore vacuum-tube method of illumination.

Two installations have already been erected in London, one outside the Savoy Hotel and another at Salisbury House. The Savoy installation consists of a tube 176 ft. in length, consuming 2,950 watts, using nitrogen gas for producing yellow light. Power factor 70 per cent. The Salisbury House installation consists of a tube 85 ft. in length, consuming 2,200 watts, with a power factor of 60 per cent. A white colour is obtained by using CO_2. I am quite satisfied that a useful field will be found for the application of this method of illumination. The use of CO_2 has enabled Mr. Moore to obtain with his tube the nearest approach to daylight yet attained, and I am given to understand that colour can be matched in such a light with extreme accuracy. This is certainly a severe test for any method of lighting.

I should also like to draw attention to one fact in connection with illumination, which seems to deserve greater consideration at the hands of manufacturers and large consumers of light, and that is the great value which ought to be attached to the adopting of proper methods of illumination. The advantages to be derived are: first, the sight of the workpeople will be improved and prolonged; secondly, the output will be quite appreciably increased; and, thirdly, which is very important, the quality of the work under proper illumination will be of the same high standard as when done in the daytime. The economies derived by not using proper methods of illumination are false economies when one bears in mind the fact that the expense of providing and keeping up proper illumination is in many cases only a small fraction compared with the value and the nature of the work turned out. This question of defining the proper amount of light necessary for different purposes forms a very useful task for the illuminating engineer.

Before closing I should like to refer to an American institution, with the work of which I was struck as being of extreme importance for the much needed improvement in lighting, and that is the work of the engineering department of the National Electric Lamp Association. Fifteen lamp-makers in the United States have combined not for the purpose of forming a trust, but with a determined object of improving the quality of the lamps they are manufacturing, and thereby maintaining a proper and high standard. The best evidence of the value of this association is the fact that lamps have been improved during the past few years considerably, and every advantage to the manufacturer has been proved to be an advantage in which the purchaser has shared. Instead of each factory employing imperfectly trained chemists to analyse the chemicals which enter into the manufacture of lamp filaments, a well paid and highly-skilled chemist is employed in a thoroughly equipped laboratory to perform this work, and sufficient resources are put at his disposal to keep on making proper researches, and keep abreast with the latest discoveries. No independent company with a capacity less than about 15 or 20 million lamps a year could possibly afford to maintain an engineering organisation which should be in any way compared to the engineering department of the National Electric Lamp Association, and it is only by reason of this association that such an engineering organisation can exist. In passing I may also mention, in connection with the necessity of testing incandescent lamps, the beautifully equipped electric testing laboratory which I visited in New York, which is so ably conducted by Dr. C. Sharp. This laboratory is munificently equipped for the purpose of testing lamps for life, candle-power, energy, consumption, &c., securing for the consumers lamps according to the standard specification. It is only by such a central organisation and well-equipped laboratory that authoritative and unbiased tests could be carried out. In view of the fact that in this country a standard specification for carbon lamps has been framed, and has come into force on July 1st, I hope before long that such a testing laboratory will also be established in this country, and will receive the proper support of the municipal authorities and companies supplying current for lighting purposes, enabling the consumers to get lamps of really good quality.

Modern Machinery and its Future Development.

By H. S. Brackenbury.

(Section G.—Abstract.)

There are forces now at work which considerably alter our views and ideas as to the value of certain classes of machinery.

Modern machine tools may be classed as follows:—

(*a*) Automatic machinery for which the tools are designed, made, and set in the machines by highly skilled labour, the material being fed into the machines by unskilled labour.

(*b*) Semi-automatic machines for which the tools are generally formed to give the work the required shape, and stops set on the machine to give the required lengths and depths of the cuts, the operator having little more to do than to pull or turn certain handles.

Under this class come capstan lathes, screw milling machines, screwing machines, &c.; in fact, all those machines where the tools can be made and set by skilled labour and then worked by little skilled labour.

(*c*) Machines which develop the work under the guidance of skilled labour to a drawing or sample, the sizes being obtained by the use of gauges or the micrometer. Such machines are the engine lathe, heavy capstan lathes fitted with lead screws, &c.

(*d*) Grinding machines for finishing work, where considerable skill is required in the handling of gauges, but very little skill to work the machine.

It has been the aim of many machine users to push work from class *c* into class *b*, and from *b* to *a*, and this the machine builders have encouraged, bringing the automatic and semi-automatic machines to great perfection, but they have tried to carry this too far, even under the old conditions, and I shall try to show that the conditions upon which the value of automatic and semi-automatic machines rested, have been completely upset by the general adoption of high-speed steel; and that the claims of the old simple type of engine lathe come once more to the front.

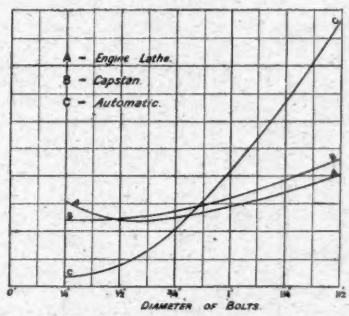
Until a few years ago, the time required for rough drilling,

turning, &c., work was a very large consideration on the total cost, including material, and it was therefore desirable to do much of this work with automatic machinery, where one man could attend to, say, four machines. But by the introduction of high-speed steel, the cost of roughing out has been immensely reduced, certainly as low as one-third the former cost. The price of material and of the more intricate types of machines has risen, the result being a complete alteration of the proportionate value of the labour to the cost of material and machine charges. The production of one automatic machine on the larger class of work is slower than the production of a hand-worked machine, and therefore extra capital charges are involved for shop room. The price of an automatic machine is at least double the price of a hand machine suitable for turning out the same piece of work, and very often on the automatic more material must be used and of a more expensive nature, a point which the machine builders are apt to leave out of consideration. Future development will not be in the direction of larger and more complicated turret or automatic lathes, but in the direction of simple machines which can be attended to by operators of average intellect who have not had much previous experience of machinery.

Automatic machines show a saving when the capital cost is not more than £250 each. After this figure a loss is shown, which increases very rapidly.

Figures are often shown which seem to prove the great value of even large automatics and expensive and complicated turret lathes. In certain cases these figures are correct, but in many cases the saving is largely due to the carefully thought-out method of doing the work, where formerly little, if any, attention had been given to the study of economy in the old machines.

I now draw attention to a set of curves showing the actual proportionate cost of wages only on bolts made (*a*) in an engine lathe, (*b*) in a capstan lathe, and (*c*) in an automatic.



Comparative Costs of Producing Bolts.—Wages only.

It will be noticed that the automatic shows a large saving on the smaller sizes; for the larger sizes the engine lathes show the cheapest method. The capstan or turret lathes show much the same as the engine lathes, but the machine charges would be much higher for both the automatics and the capstans.

TABLE I.—16 in. Centre Lathe.

Revs. of spindle per min.	Horse-power at 40 lb. belt tension.	Diameter at 40 ft. per min. cutting speed	Section of cut.	
			Decimal sq. in.	Depth × traverse.
41·0	12·95	$3\frac{3}{4}$″	·0477	·763″ × $\frac{1}{16}$″
23·6	10·85	$6\frac{1}{2}$″	·04	·64″ × $\frac{1}{16}$″
14·4	8·76	$10\frac{5}{8}$″	·0322	·515″ × $\frac{1}{16}$″
8·8	6·66	$17\frac{3}{8}$″	·0244	·39″ × $\frac{1}{16}$″
5	4·57	$30\frac{1}{2}$″	·0167	·267″ × $\frac{1}{16}$″

The automatic shows to the best advantage on simple work, when the cutting time is a large proportion of the whole time. The reason of this is that the time taken to change from tool to tool on the automatic machine is longer than that required on the hand capstan machine; so that the longer the cutting time, and the fewer the number of tools employed, the better is the result from the automatic.

These curves show the tendency very clearly of the work to become more and more expensive as the size of the automatic machine increases. The simple automatic machines of small size are of the greatest value. The complicated machines for work requiring many short operations are not economical.

I come then to this conclusion:—

The use of automatic turning machines is for small work of a simple nature.

The use of large expensive turret lathes is for finishing work of a complicated nature or form, requiring considerable variety of tools.

To rough the work to nearly the finished sizes we require simple machines suitable to be worked by boys.

Curiously enough, these machines, which seem the most simple and easy of perfection, give the most room for development. The reason of this is that the great value of roughing-out work in cheap machines with cheap labour has not been sufficiently grasped.

Supposing the cost of tools for roughing the same in both the expensive turret and the cheap capstan, and supposing the former costs £400, as against £100 for the latter, and wages per hour 8d., as against 3d., I find that the cost is as 16 to 5.

In the design of these roughing-out machines, I should advise the driving to be done by means of a single pulley running on a back shaft with a wide belt, and not a cone pulley; the change of speeds would be obtained by means of sliding gear wheels made of steel. I would not make provision for too large a range of speeds, as when a speed is too slow for the best results from the tool the feed can be increased, which gives the same results.

Taking as an example a lathe of well-known make I find that the horse power carried by the belt varies from 12·95 to 3·54. Evidently the value of a large range of speeds is very doubtful when it is combined with such a range of horse power. (See Table I.)

I come to the question of finishing the work. The accuracy required for finished work is now of a far higher nature than formerly. It is recognised by everyone that interchangeability is a necessity and an economy, and this can only be obtained by making the work to a small tolerance of error.

If the work is of a complicated nature it will be an advantage to employ the turret lathe as previously described, or the higher class of engine lathe may be used.

If, however, the work is of a more simple nature, the modern grinding machine will be employed.

We may look to the future to make the use of the grinding machine far more extensive. Machines of a cheaper nature will be introduced to finish much of the work which is at present finished in the lathe.

Magnetic Observations at Falmouth Observatory.

Report of the Committee, consisting of Sir W. H. Preece (*Chairman*), Dr. R. T. Glazebrook (*Secretary*), Prof. W. G. Adams, Dr. Chree, Captain Creak, Mr. W. L. Fox, Sir A. W. Rucker, *and* Prof. Schuster.

(*Section A.*)

The grant voted by the Association last year has been expended in maintaining the magnetic observations at Falmouth Observatory. The results of the observations have been published in the Annual Report of the National Physical Laboratory, as well as in that of the Royal Cornwall Polytechnic Society.

The mean values of the magnetic elements for the year 1906 are:—

Declination	18° 5′·3 W.
Horizontal force...	0·18790 C.G.S.
Vertical force	0·43344 C.G.S.
Inclination	66° 33′·7 N.

The Committee are informed that the Observatory at Eskdale Muir will be ready for occupation this autumn. It is clearly important for the sake of continuity that the Falmouth Observatory should be fully maintained until Eskdale Muir is in complete working order. To secure this the Committee ask for reappointment, with a grant of £50.

Reinforced Concrete Poles.

In his paper on "New Uses for Reinforced Concrete," read before Section G, Mr. W. Noble Twelvetrees, M.I.Mech.E, touched upon such constructions as railway sleepers, standards for overhead electric cables in power transmission and electricity distribution systems, and poles for telegraph and telephone wires.

Reinforced concrete railway sleepers are to be found on several lines in the United States. Of the Campbell sleeper, some 150 were laid down on the Elgin, Joliet, and Eastern Railway in 1905, and 1,000 on the Chicago, Lake Shore, and Eastern Railway during last year. This sleeper is of concrete, reinforced by two old boiler tubes and a surrounding ring of wire netting. According to the published results of tests, the Campbell sleeper is capable of withstanding loads up to 80,000 lb. applied at the rail seat before showing signs of failure by crushing, and of supporting transverse loads up to 10,000 lb. applied at the middle, the rail seats being supported on blocks at the distance of 5 ft. apart.

Sleepers of the type adopted on the Chicago and Alton Railroad by Mr. G. H. Kimball have been in service on that line since 1901, and have proved capable of withstanding the effects of traffic in a perfectly satisfactory manner. The sleeper consists of two blocks of concrete, each 3 ft. long by 7 in. thick by 9 in. wide, connected by two 3-in. steel channel bars embedded in the concrete blocks. The rails are secured by spikes upon hardwood blocks intended to absorb shocks and distribute pressure.

Other types of reinforced concrete sleepers are in use on several American railways, and the fact that the employment of the material for the purpose has been taken up seriously in a great timber-growing country should serve as a hint to railway engineers in this country, where the cost of timber tends to increase year by year.

The Caio sleeper, adopted experimentally on the Italian railways in the year 1900, has shown satisfactory results, and it is stated that the authorities have decided to lay 300,000 sleepers of the same type. The sleeper is reinforced in a somewhat complicated manner by longitudinal steel rods interlaced with wire, while vertical rods

and netting are placed beneath the chair seats and some netting in the middle portion of the sleeper.

Reinforced concrete poles have been used for some time past for carrying the cables employed in power-transmission systems in various Continental countries. An improved method of construction has recently been introduced by Messrs. Siegwart, of Lucerne, for the production of hollow poles by means of a special machine, the poles being made to any required length and taper, and the concrete reinforced suitably for the length and the load to be carried.

Reinforced concrete standards for power-transmission lines are also coming into extensive use in the United States. The standards for a three-phase power-transmission line are 49 ft. 7½ in. high, with a minimum clearance of 30 ft., and are reinforced with 12 ⅜-in. and ⅞-in. longitudinal bars, and a spiral winding of ⅛-in. steel wire.

The utility of reinforced concrete for purposes such as those now under consideration should appeal to the Post Office and railway companies, as well as to those concerned in electricity undertakings, since reinforced concrete is an ideal material for the construction of telegraph and telephone poles. An instance of enterprise in this direction has been afforded by the Pennsylvania Railroad, by whom a mile of telegraph poles was erected in the autumn of last year. The poles, from 25 ft. to 34 ft. long, were made of concrete, reinforced with 24 ¼-in. rods, and their transverse dimensions were 8 in. square at the bottom, tapering to 6 in. square at the top, the corners being chamfered so as to give an octagonal cross-section above the ground. The work was hurried, so as to have the line ready for inspection at a given date; and, in consequence, some of the poles were erected within five days after they had been made. Notwithstanding this hasty construction, and the severe windstorms of last winter, it is stated that the poles were in almost perfect condition in May this year. This experience is sufficient to indicate the exceptional suitability of reinforced concrete for the purpose named.

Amongst many other examples, the author gave instances of railway bridges constructed of this material, a great advantage, in addition to the small initial cost, being the durability of the structure without the necessity for periodical painting.

On the Application of Water Power, and how to Secure the Greatest Efficiency in Working the Same.

By John Smyth, M.A., M.Inst.C.E.I., F.R.Met.Soc.

(Section G.)

There are many falls of water which are not utilised because they are considered too small and the supply of water too irregular to pay for the outlay in applying them. I hope to show, however, in this paper that such may be made valuable by using a variable auxiliary power to supplement the water power.

On the Upper Bann River in the North of Ireland there are a number of these small falls. On one of these the fall is 8 ft. 2½ in., but as there is a loss from a long and somewhat narrow race in part of its course, only 7 ft. 6 in. is reckoned on. Two Achilles turbines, one 48 in. in diameter and one 36 in., have been erected on this fall. They are capable of driving 126 H.P., with a discharge of 11,095 cb. ft. per minute at full gate of sluice, but as it is an advantage to work with something less than full gate with such turbines, they are never required to do more than about 112 H.P., or 15 H.P. per foot of fall. There are reservoirs provided for the river by a public company to keep up the normal supply in summer and in scarce times to 4,500 c.f. per minute or 54 H.P., equal to 7·2 H.P. per foot of fall. At these and intermediate times, the necessary power for the machinery is kept up by a steam engine, so that one year with another it is estimated that an average of 83 H.P. is obtained, or about 11 H.P. per foot of fall. Had a turbine, or turbines in this case, been erected for only the normal supply, a loss would have resulted of 3·8 H.P. in the year's working (or £19 per annum if steam were used for 10 hours' drive per day). A steam engine is used as the supplemental motor in this case, as the works are used for bleaching, where the steam is passed through a high-pressure engine at 65 lb. per square inch and leaves it at about 4 lb., passing into another boiler, thence to do the boiling and heating required in such works, and thereby great economy is secured.

In other works the supplemental power might be obtained from an oil or gas engine.

The Achilles is an American turbine, which is said to be an improvement on the Hercules turbine, which was introduced by Mr. McCormick, of Holyoke, in 1876. The city of Holyoke is said to be possessed of a large water-power, well developed and conserved, and has also a public testing flume; Messrs. John Macdonald and Co., Pollokshaws, near Glasgow, supply and erect these turbines. Any water motor which works well with a supplementary power will, however, prove the same thing.

There are two or three other falls in the Bann River which are worked in much the same way, with some modifications, but there are a great many others where the full power of the water is not taken advantage of, and some others where the fall is not used at all.

I believe the same state of things obtains on a great many other rivers, both in Ireland and elsewhere, and thus a large amount of wealth not only is wasted, but lost. This is especially to be deplored in a country where the people are poor and coals dear.

When giving evidence before the "Arterial Drainage Commission Ireland of 1905," I drew attention to a means of preventing or modifying the flooding of lands within the drainage area of rivers by the construction of compensating or subsidiary reservoirs on lakes or poor lands along the course of the river into which the floods might be drained and impounded, and gradually withdrawn afterwards to the lower reaches as required; at the same time the purer water on the higher reaches could be impounded and reserved for the supply of towns. Thus the full advantage would be taken of the entire drainage area of each river. Were this done the several falls on each river would be further increased in value in proportion to the use they could make of these reservoirs.

In a paper "On the Industrial uses of the Upper Bann," read before this Association at the Belfast meeting in 1874, and published *in extenso* in its report, I mentioned one such reservoir, which had then for many years been of great service to the mills. This Corbet reservoir (as it is called) is still proving its great usefulness to the river, in fact, supplying half as much as Lough Island Reary reservoir at the head of the river, which has nearly 10 times its capacity; the latter, however, has a drainage area of 5 sq. miles, whilst the former takes its supply from a point on the river where the drainage of 80 sq. miles flows past.

I wish especially to bring this matter under the notice of engineers and mill-owners, as I am well aware of the fact that the value of water power is much under-estimated; this, I believe, has arisen in a great measure from the general use on low falls of imperfect and inefficient water motors yielding small percentages of the theoretical power of the water, and the neglect to use the full flow of the water in all seasons.

There is no difficulty now in procuring water motors for all heights of falls to give 80 per cent. of the theoretical power in place of from 50 per cent., or still lower, to 70 per cent., as has been too much the rule hitherto.

In the works spoken of above, two upright breast water wheels, made from the plans of the late Sir Wm. Fairbairn, have been replaced by these American turbines, which have given a very much higher percentage of the full power for low falls.

"LET US NOW PRAISE FAMOUS MEN."

By An Engineer.

Recent events have brought before us the fact that the architect, like the poor, is always in our midst, neither doth he hide his candle under a bushel. Rather doth he clothe himself with the raiment of omniscient knowledge and perform such tricks as make high heaven and lowly ratepayers weep.

It will be remembered that some three years ago a plaintive manifesto was officially issued to all local authorities, urging that architectural work of a monumental character should be entrusted to independent architects and not left to the tender mercies of engineers and surveyors.

There was a pleasing vagueness as to the precise definition of the term "monumental"; probably it referred more to a town hall than a public urinal. If, however, the adjective was intended to apply to a workhouse, the delicate irony of the circular is now more apparent than ever.

It was, no doubt, and still is, annoying to architects to see the surveyors and engineers of Councils designing buildings equal to any of their own creations in decorative effect, more conveniently planned, and of less expensive construction.

The humour of the situation at the time when the above-mentioned appeal was distributed lay in the fact that, for many years past, architects had added the true functions of consulting engineers to their own qualifications, and that the majority of their monumental triumphs were in this respect but whited sepulchres. Architects might, of course, make themselves responsible for engineering work. After all, what does it amount to? You just run through the estimate of some obliging contractor, and there you are, and there is your 5 per cent. commission, which you take with an unshaking hand. The absolute immorality of employing engineers or surveyors to design buildings, on the other hand, cannot be condemned too strongly!

So time went on till, thanks to "our John," the populace has had an opportunity of admiring the mighty works of the genus architect in a marvellous transformation scene—designer of buildings, mechanical engineer, electrical engineer, laundry expert and general stage manager.

Unfortunately, neither large nor small outlays necessarily ensure low working expenses.

Few people have any idea of the poor condition of the engineering plant in very many public institutions and the consequent waste of coal and money—a state of affairs almost invariably due to the architect, whose ignorance of mechanical subjects is only exceeded by his disgust for anything of such a practical nature. The amount of public

money wasted by architects masquerading as engineers can only be fully appreciated by the latter.

The general arrangement of the boiler house, engine room and laundry, with their possible extensions, a most important point, the questions of heating, ventilation, water softening, electric lighting, and many other details should all be considered and decided upon before the plans of an institution are finally approved.

Your architect does nothing of the sort. He designs his building, the engineering plant is put anywhere; electric lighting is added, perhaps, at the last minute, so to speak, water softening plant may be erected in a few years' time, there is no thought of economising steam. There is, in fact, no fixed design at all for this section of the "monumental" edifice. It is to all intents and purposes the grave of its designer's reputation as an engineer.

A church architect acts in the same manner, the organ is placed in any handy corner without regard to the acoustics of the situation. Fortunately the working expenses of organs do not vary to any extent with their position. The working expenses of the plant in a public institution do, and its economy is largely dependent on careful attention to details in its design and arrangement.

Again, in the event of building tenders standing at a higher figure than the designer's estimate, an unhappy occurrence not entirely beyond our mortal ken, even when an F.R.I.B.A. is employed, the architect is often instructed to revise his designs.

What happens? Well, one size of boiler is as good as another at a pinch in his estimation, and so on right through the equipment, which very likely was not correctly estimated for in the first instance. The cost of the building work no doubt is reduced as well, probably it is rendered less monumental in character, but nobody knows or cares about the boilers and heating arrangements until the place is opened. Then there is trouble in the camp, the board blame the architect, he blames the contractors, and they unanimously agree that the resident engineer is incompetent. *Voilà tout!* But when several engineers have either been discharged or have thrown up their work in disgust, a consulting engineer may be called in. It is then found that while comparatively small extra expenditure on more suitable plant at the outset would have effected a considerable saving in working expenses, the necessary outlay is now practically prohibitive owing to the interest and sinking fund charges payable, not only on the cost of the alterations, but also on the original plant.

It is admitted that in some instances the engineering work has been entrusted to an expert by the architect, but in many of these cases it is obvious that the former has not been called in early enough. His duty has been to provide electric lighting plant, or to arrange for the equipment of the laundry, more or less in accordance with the architect's preconceived ideas, and he has been limited as to capital outlay by an estimate included in the building quantities. Further, the engineer has in several instances been connected with some manufacturing firm. The beauty of the situation is obvious. He naturally specifies apparatus made by his firm, on which he makes a profit. He can therefore afford to undertake the consulting work either for this profit alone or for a lower commission than the independent consulting engineer.

It must not be inferred that the plant supplied in such cases is necessarily of an inferior quality, but such procedure does undoubtedly militate against the adoption of the most effective apparatus for any given work, and the engineer is also more or less in the hands of the architect, and *vice versa*.

Architects, as a rule, appear to have no idea of the amount of detail involved in dealing with the simplest engineering matters. Contractors are asked their price for, say, a steam pump, or a disinfector, in an offhand manner, and their request for further particulars before quoting a price is looked on as a proof of their incompetency.

Great difficulty is also experienced in obtaining interviews with architects. In this respect they easily distance consulting engineers. The latter generally manage to find time to discuss any new system or apparatus. The former stand over a drawing board with their backs to the caller, while an assistant courteously informs him that Mr. Blank is so engaged on his various monumental edifices that he cannot spare a minute. Mr. Blank always is engaged too, absolutely wedded, in fact, to his art. The result is that his clients often have to put up with more or less obsolete plant and consequent loss of efficiency.

There are, of course, exceptions, and these gentlemen will probably be the first to admit the correctness of the above remarks.

The engineering of their institution work is entrusted to competent consultants with satisfactory results, but even then the engineer may not be called in early enough, to plan out the equipment as a whole.

It is impossible to lay too much emphasis upon the fact that the supply of heat, light, and motive power should be considered together, as the various details that make for continuity of supply, for satisfactory working, and for economy, all hinge one upon the other.

One of the most important features in the engineering of public buildings is the judicious use of exhaust or waste steam.

Great improvements have been made during the last few years in heating systems, but the value of exhaust steam for either hot water or steam heating has not as yet received the attention it merits either from those responsible for the management of public institutions or from their architects. The former look to their architect for advice, the architect assumes that because steam heating has proved unsatisfactory in the past it must always remain in the same condition, and will have none of it.

As a matter of fact, the warming of many buildings can now be efficiently carried out almost entirely by the exhaust steam from the various engines in use on the premises, and the question is one which should be investigated by all boards of management. The resulting economy will in many cases reduce the coal bill to a marked extent after due allowance has been made for the interest on the cost of the alterations. Once again, what argument can be urged for the employment of an architect to prepare plans for a laundry? This is entirely an engineering work, and requires exceedingly careful treatment. The architect invites tenders for the equipment of the building, and receives, say, a dozen; he then selects the lowest quotation, utterly oblivious of the fact that no two tenders are drawn up on the same basis, and that no comparison is, therefore, of the slightest value. Further, if the tenders could be compared, has an architect the requisite technical ability so to discrimate? The answer is obvious. He is entirely in the contractor's hands, and so are his clients.

The extras on such contracts are usually excessive. This is accounted for by the indefinite wording of the manufacturer's original specification, which rarely covers everything necessary for the completion of the work. In the end the capital expenditure is far greater than it would have been if proper specifications had been prepared by an engineer, and the arrangement of the plant is less satisfactory.

It should be borne in mind that a contractor's aim is to supply apparatus on which he can make the most profit, always provided such apparatus will perform the work required.

A consulting engineer, on the other hand, views the plant as a whole, and arranges each detail to give the best results.

The radiation losses in steam pipes, for instance, do not in the least concern a contractor, but the matter is of considerable importance to those who desire to economise in working expenses.

The money lost through unprotected steam pipes is by no means a negligible quantity. The loss from a bare pipe only 2 in. in diameter, carrying steam at a pressure of 80 lb. for 12 *hours* per diem, amounts to 2s. 10d. *per foot length per annum*, taking the price of coal at 20s. a ton.

The application of good non-conducting material to the pipe will reduce this loss by at least 80 per cent., a saving of 2s. per ft. length per annum. Bare steam pipes are, however, frequently met with in institution work.

It may be said that this article is written with the idea of securing work. Even admitting the soft impeachment, why should such matters not be entrusted to those who have made a special study of the subject? Further, engineering work of this description is of comparatively small

importance to those engineers who possess the requisite experience to deal with it successfully.

It is far more to the advantage of the ratepayers at large that an impartial expert, unconnected with any contracting firm, or special system, should advise upon such matters than it is to the expert himself. The adoption of his recommendations may save a large annual sum, but his own profit on the transaction will probably only amount to a few pounds. Some may remark, "We would rather employ an architect than an average engineer." Their experience has, no doubt, been a bitter one. It merely serves to emphasise the fact that engineering work of this description calls for a large amount of discrimination and practical knowledge. Still, admitting that there are engineers and engineers, who but an architect puts down *three* vertical boilers to supply steam to a Union when *one* Cornish boiler would do the work with 35 per cent. less coal, to say nothing of the short life of a vertical boiler and the danger of forcing it? Who but an architect lays steam pipes direct in the ground, or for that matter, erects them uncovered in trenches and buildings? Who but an architect makes an error of 100 yds. for 100 ft. in setting out the distance between one block of buildings and another?

Why, the list could be extended till the crack of doom. Who but an architect provides radiators with insufficient heating surfaces, chimney shafts, boilers and engines, sometimes too large, but generally too small, a boiler house in which the ashes have to be taken out over the boiler settings, inaccessible steam pipes, and other details affording amusement and derision to engineers?

These charming instances of engineering ability on the part of various architects can all be inspected, and doubtless many others.

Nor are these blunders perpetrated, nay more, perpetuated, by unknown men. One is a county architect. He should evidently become an inmate of some convenient "building of a monumental character."

The conclusions to be drawn are surely that, in the first place, the engineering work of public institutions should be directly entrusted to experienced and impartial consulting engineers by the authorities concerned before the plans of the buildings are finally approved. Secondly, that architects should be required to confine their attention to matters on which they are competent to advise.

The engineering plant in the majority of institutions bears mute and touching witness to the fact that engineering is emphatically a matter which architects are not, and never have been, qualified to deal with. The subject will well repay the careful attention of all local authorities.

HOW TO "GET ON."

By "BINNACLE."

This question has been briefly touched upon in "Glover's Almanac" for 1907-8 under the heading "Guides for Getting On," but the limited space allotted to the writer for this purpose was quite inadequate for the full consideration of the subject.

In the present article this important problem is considered at greater length for the benefit of the younger toilers in the electrical industry.

The art of "Getting On" has become of paramount interest to young electrical engineers during the last decade, more particularly in connection with those engaged in our large electrical manufacturing concerns, and it is proposed in this article to lay down a few general rules for the assistance of these unfortunate individuals.

It may be thought that more severe competition exists amongst central station engineers than in the manufacturing branch of the industry, and this is doubtless the case as regards the obtaining of a berth, but once a position is secured the central station engineer who cannot retain it must be of a very feeble description indeed, whereas the struggles of the assistant in a manufacturing undertaking are only just beginning when a post has been allotted to him. His work is subject to review at frequent intervals by his superiors, and if the manager has reasons for supposing that a better man can be obtained at the same cost, no hesitation is felt in making a change. This state of things is the natural outcome of extreme competition, and shorter periods of employment in one position or with the same firm, are likely to prevail in future than have ruled in the past.

These remarks do not apply to clerical posts, where the duties are strictly limited and recur week after week with unfailing regularity. Here the assistant becomes accustomed to his task, and can perform it more quickly and effectively than a newcomer, hence, as long as he behaves himself, no reason can exist for making a change. The technical staff are very differently situated, their duties are generally unlimited, and it is to the interest of the management to get as much work out of them as possible, with the natural consequence that as the supply of trained assistants increases, their duties tend to extend, whilst salaries remain constant or actually decline.

One might suppose from the foregoing remarks, that technical knowledge and hard work were the only factors of importance in "getting on," and if those in responsible positions knew exactly the capabilities and output of each of their assistants, these factors would practically control the advancement of the latter. Unfortunately, those in charge never fully obtain this information regarding their staff, and even if they were capable of forming an accurate estimate of each man's value, their selections for responsible posts would still be influenced by personal considerations. This latter feature requires very careful attention by every aspirant for an improved position, and the rules set forth below will be entirely confined to this aspect of the problem. For men of exceptional ability, the following hints will have little value as they would get on with or without such assistance, but those having only average endowments may easily advance their interests by carefully ordering their conduct, as distinct from the actual duties performed.

One of the greatest bars to a young man's progress is a sense of humour, and those cursed with this attribute should spare no pains to conceal it during business hours. Many incidents occur which give you a mixed feeling of amusement and pleasurable excitement when your attitude should indicate sorrow and resignation.

For instance, the office lighting, perhaps, fails at 3 o'clock on a December afternoon, resulting in a suspension of work for the remainder of the day, such a breakdown and stoppage of work will cause pleasure and amusement to many of the staff, but any indication of these natural feelings will be looked upon with strong disfavour by the authorities. If you wish to "get on" your appearance must show subdued irritation at the interruption of your work. Then again a commutator on a machine being tested may fly apart, some of the sections being gathered up in an adjacent township. If no one is hurt, the man cursed with a sense of humour will be amused at this "Katherine Wheel" display, but he must on no account exhibit such a feeling when apprising the manager of the event. His behaviour should rather indicate sorrow for the damage done to the roof and annoyance at the delay and expense involved by the collection of the roving sections and the rebuilding of the commutator.

The same principle applies to dealings with customers, and a failure of their machinery should never cause a smile, however grotesque the results may have been. The only exceptions to the total suppresion of mirth occur when jokes are made by those placed above you, in which cases your risible faculties may be given free play, and they must even be forced on occasion.

Never complain of the conditions under which you work, unless you can suggest a remedy; mere grumbling is very harmful to your prospects.

As a general rule you should "Sir" your superiors, they all like it, and those who say the practice has no effect upon them are usually more susceptible to its influence than others.

Make a point of being hard at work by the time your chief arrives in the morning, and never rush off at the signal to cease work for meal times or at night. Instinct will indicate almost exactly when time is up, and your natural feelings will incite you to look pleased and to hurry away

promptly. Such emotions as these must be entirely suppressed, the correct attitude being one of undisguised astonishment succeeded by irritation, and you will finally tear yourself away after several minutes of studied absorption in your duties.

No engineer who is anxious to improve his position should ever cultivate a hobby, or if he must do so, all knowledge of it should be carefully kept from his employers. The latter always like to think that you have absolutely no interest in life other than the success of their undertaking, and your conduct should justify this belief as far as it is known.

The above principle does not, however, altogether apply to marriage, and provided domestic interests are kept entirely in the background, the modern manager is rather inclined to favour a married man, as the notion is prevalent that he will be compelled to work harder than a bachelor. It is difficult to lay down general rules on this question of matrimony; if the head men in a concern are married, the course indicated above is correct, but single managers do not always appreciate the occasional absences of their staff necessitated by family cares, and it is sometimes better under such circumstances to ask for a holiday without giving a reason.

You must never be ill, but for some unexplained reason it is advisable to take a day off now and then, whether you want it or not. The effect of this procedure, if carried out in moderation, enhances your value by drawing the attention of the authorities to yourself, which is essential to your advancement. This question of attracting attention is most vital, and if it cannot be compassed by any other means, it is better to make a mistake or two than to go on month after month doing your work perfectly and thus being entirely overlooked. This advice must not be misunderstood; in the first place, it is safer to excite interest in your employers by putting forward new ideas, but if this plan is not feasible, a few mistakes will do you more good than harm if your work is satisfactory in other respects. On the other hand, should the results of your labours have proved disappointing an error or two may ensure your dismissal.

Do as you are told without argument or comment unless you are consulted, in which case, if your chief holds strong opinions, your correct course is to allow him to convince you of their sapiency, when they should be adopted with enthusiasm.

Technical knowledge and hard work have their proper places as aids to advancement, but experience tells us that a knowledge of human nature as portrayed in those placed above you is often of greater importance in the struggle for success.

Cost of Hydro-electric Works.—In a recent issue of *l'Industrie Electrique*, in the course of an article on the electrolytic manufacture of alkaline chlorates, the capital expended on the plant at Vallorbe, Switzerland, is detailed. The height of fall is 70 m., the power utilised amounts to 3,000 H.P., and the output of the works is 900 to 1,000 tons of chlorates per year, calculated at the round figure of 1 ton per horse-power per diem. The expenditure was allocated as follows:—

Concession and land	£1,200
Dam	800
Tunnel, &c.	2,000
Pipe line	1,200
Turbines and sluice-gates	4,400
Buildings...	800
Dynamos	12,000
Sundries	1,600
Total	£24,000

Thus the cost per horse-power was £8. Interest and depreciation at 10 per cent. make £0·8 per H.P. per annum. These results are exceptionally favourable; more usually, it is stated, the cost of installation would average £20 per H.P., and the annual charges £2. In Norway, however, it is anticipated by the company which works the Birkeland-Eyde process that the annual cost will not exceed £0·6 per H.P.-year. A project which has been drawn up for the utilisation of the power of the Rhine at Kembs and Petit-Landau, contemplating the development of 42,000 H.P., is estimated to cost two millions sterling, or £47·6 per H.P. The high cost is due to the small head and the correspondingly immense volume of water to be dealt with. With such favourable conditions as obtain at Vallorbe, the cost of energy forms an insignificant percentage of the total cost of production of chlorates.

JAPANESE ELECTRICAL IMPORTS.

In our issue of July 19th, page 92, we gave a summary of the principal figures of interest in the latest return relating to Japanese electrical imports. We are now enabled, by the courtesy of an esteemed contributor, to publish the following useful analysis of the returns, together with the deductions drawn therefrom by him. The object of the analysis was to see whether the decrease per cent. of British trade was proportionate to the total decrease per cent., and if British trade had suffered more than others:—

Japanese Imports in Thousands of Yen.

		1905.		1906.					
						Increase.		Decrease.	
		1,000 yen.	%	1,000 yen.	%	1,000 yen.	%	1,000 yen.	%
Electric lighting apparatus or instruments.	Untd. Kingdom	105	16½	127	25½	22	21	—	—
	United States	465	73	340	68½	—	—	125	27
	Germany ...	63	10	23	4½	—	—	40	64
	Other countries	—	—	6	1¼	6	—	—	—
	Total ...	633		496		—	—	137	21½
Electric motors.	Untd. Kingdom	423	17¼	326	23	—	—	97	23
	United States	1,860	75	862	61½	—	—	998	53½
	Germany ...	167	6¾	184	13	17	10	—	—
	Other countries	5	¼	36	2½	31	620	—	—
	Total ...	2,455		1,408		—	—	1,047	42½
Electric light wire.	Untd. Kingdom	307	40	458	55	151	49	—	—
	United States	391	51	328	39	—	—	63	16
	Germany ...	61	8	19	2¼	—	—	42	69
	Other countries	2	¼	27	3¼	25	1,250	—	—
	Total ...	761		832		71	9¼	—	—
Electric cars.	Untd. Kingdom	250	47	49	16	—	—	201	80
	United States	276	52	257	84	—	—	19	7
	Germany ...	4	¾	—	—	—	—	4	—
	Other countries	—	—	—	—	—	—	—	—
	Total ...	530		306		—	—	224	42½
Telegraph wire.	Untd. Kingdom	35	3	27	2½	—	—	8	23
	United States	81	6¾	221	19	140	173	—	—
	Germany ...	943	78	845	74½	—	—	98	10½
	Other countries	147	12	45	4	—	—	102	70
	Total ...	1,206		1,138		—	—	68	5½
Steam boilers and engines.	Untd. Kingdom	1,644	62½	1,461	67½	—	—	183	11
	United States	894	34	647	30	—	—	247	27½
	Germany ...	56	2	41	2	—	—	15	26½
	Other countries	39	1½	13	½	—	—	26	66½
	Total ...	2,633		2,162		—	—	471	18

(Note.—The percentages are only approximate, having been reckoned on a pocket calculator.)

Notes.

1. All imports have decreased, except electric light wire, in which there is a small increase, chiefly from the United Kingdom.
2. Motors and cars have decreased nearly one-half.
3. Total imports of electric light wire have increased 9¼ per cent., but British goods of this class have increased 49 per cent.
4. Total imports of electric light apparatus have decreased 21½ per cent., but British goods have increased 21 per cent.
5. These are the only two increases of British goods.
6. While British boilers and engines have decreased by 11 per cent., they are still two-thirds of the total imports of this class.
7. The only increase in goods from U.S.A. is in telegraph wire, but Germany still supplies nearly three-fourths.
8. The only increase in goods from Germany is in motors, but nearly two-thirds still come from U.S.A.

ELECTRIC SHOCK FATALITIES.

Two years ago (Electrical Review, September 15th, 1905), we published a tabulated list of the electric shock fatalities that had been recorded in our news pages from July, 1904, down to that date. We now give in similar form particulars of the fatalities that have been reported between Sept., 1905, and the beginning of the present month.

Date of Accident.	Occupation of Victim.	Character of Accident.
1905.		
October ...	Dockfooter employed at Lady Victoria Pit of Lothian Coal Co.	Victim touched a steel girder which had become "alive" through contact with an injured insulated electric light wire; 500 volts. Victim was perspiring freely. Ground damp.
Oct. 5 ...	Gymnast (aged 27) practising in ballroom at Brixton.	Victim had hold of a steel wire with one hand, other resting on an electric light bracket; 220 volts. Death appears to have resulted from 20 ft. fall.
Nov. 4 ...	Electrician at Hammersmith B.C. power station (aged 24).	2,500 volts. Removing ammeter from distributor board. Ignored regulation to use rubber gloves. One foot on rubber mat, one on stone floor. Right hand burnt where deceased clutched key.
November ...	Labourer (aged 30) engaged at oil works, Oakbank Oil Co.	300 volts. Clothes wet against body, back and front of neck alternately in contact with two electric wires 18 in. apart.
Nov. 15 ...	Drawing tubs at Ince Hall Colliery (aged 20).	Contact with electric wires by side of road. Cable entangled in angle iron of tub, which had left road. Deceased trying to get tub back; angle iron cut insulation. Government inspector suggested use armoured cable.
Dec. 2 ...	Fitter at work in blacksmiths' shop, Pelton Colliery.	(? 254 or 440 volts.) Holding portable lamp with flex from lighting circuit attached, handle touching breast.
Dec. 27 ...	Engineer-in-charge (aged 24) Glasgow sub-station, erecting new machine. Preparing switches for H.T. current to be put on.	Was drawing out isolating switch, when current (6,500 v.) was suddenly and without warning turned on from Port Dundas.
1906.		
Jan. 5 ...	Painting iron girders, Cadeby Colliery.	Slipped, caught hold live wire, fell 8 ft.
Jan. 5 ...	Repairing joint in pipe at Lower Duffryn Colliery, near 3,300-volt uncased wires.	Lost footing and came in contact with wires. Coroner urged proper protection of wires.
March ...	Assistant electrician, Notting Hill Gate sub-station, Central London Railway (aged 26).	Discussing tightening of bolts on high-tension board, hand touched live bolt above level of head; 5,000 volts.
April	Arc lamp trimmer at works of Patent Shaft and Axletree Co., Wednesbury (aged 18).	Found lying on floor, holding arc lamp; 200 volts. Deceased unaware current was on.
May 29 ...	Coal-cutter attendant at Emily Mine of Arneston Coal Co.	Came in contact with live wire when adjusting wire haulage rope.
May 30 ...	Employé at Callender's Cable Works, Erith.	Tank cables under test. Deceased found clinging to drum of cable; small leakage in cable. Fellow-workman had shock and suffered no ill effects. Victim in poor health; valvular disease of the heart. No burns or discolourations to indicate shock. (Voltage 8,000 ?)
June 12 ...	"Pusher" driver (aged 20) in coke yard at Pyle and Blaina Works, Blaina.	Fellow-workman observed deceased thrown violently from engine. Electric shock, hand burnt.
July	Electrician, Patent Shaft Works, Wednesbury.	Caught hold live wire, 1,600 volts, while localising breakdown.
July 18 ...	Two men, one a mechanic, putting up engine at Cumneol, Aberdare.	Contact with live wire connected electric winding plant at a Powell-Duffryn colliery.
July 30 ...	Electrician (aged 22) at Airedale Foundry, Unslett.	Slipped when connecting up motor, caught hold of live wire.
August ...	Foreman labourer erecting scaffold at Clyde Valley Power Station.	Hand in contact with live wire.
Aug. 8 ...	Foreoverman at Dean and Chapter Colliery, Ferryhill.	Stay-wires on electric wire post had become alive. Deceased tried to rescue two boys in contact with them, and received shock. Boys recovered. Voltage 220 or 500. Very wet day. Jury suggested removal of pole to safer position.
Sept. 6 ...	Corporation workman, Darlington, repairing overhead tramway wire.	Not wearing gloves, using ordinary ladder instead of tower ladder, received 506 volts shock, fell 18 ft.
September ...	Mechanic, Brimsdown Power Station.	Deceased, holding 2 or 3 ft. of copper tube, went without authority into cable trench under high-tension room to borrow a tool; stumbled, and fell across high-pressure terminal. Shock of 10,000 volts probable.
Sept. 20 ...	Butcher (aged 21) in damp pork-pickling cellar (brine).	Contact defective electric fan switch, 200 volts. Healthy man, boots and hands saturated with brine.
Nov. 23 ...	Engineer (aged 33) in engine room at bleach works, Stubbins, Ramsbottom.	Deceased found with lighted lamp clasped in both hands; 440 volts.
Dec. 12 ...	Electrical engineer (aged 24) Coventry Ordnance Works, Scotstown.	Contact with live wire.
Dec. 21 ...	Foreman electrician, Clyde Valley Electrical Power Co., Hamilton (aged 30).	Deceased was lifting live wire, when head came in contact with switch.
1907.		
Jan. 21 ...	Youth (aged 17) at Hartley's Leather Works, Ravensthorpe.	Low-voltage shock while interfering with electrical apparatus.
Feb. 11 ...	Unskilled labourer (aged 47) at L.C.C. sub-station, Mildmay Park.	Body found 20 ft. from live apparatus. Suggested that deceased deliberately placed his hand on conductors in cells of high-tension switchgear. Voltage of shock probably 3,800; or if both hands, 6,000 v.
Mar. 27 ...	Master shifter (aged 32), Lambton Colliery, supervising mechanical coal-cutter.	Cable jammed against chock, and insulation torn off; 500 v.
April 25 ...	Electric engine driver (aged 28) at Moreen Colliery, Cwm.	Deceased caught hold of joint which had been repaired by himself, without authority, and was defective. Jury condemned practice of allowing unauthorised persons to repair breakages.
April 29 ...	Blacksmith (aged 28) at Acklam Iron Works, Middlesbrough.	Iron bar in one hand, piece of plate in other; plate damaged insulation; 250-v. wire.
April 29 ...	Electrical engineer in test room of British Westinghouse Co. at Trafford Park.	Found dead, hands in contact live wires.
May 3 ...	Stoker (aged 37) at Fever Hospital, New Cross.	Shock from defective lamp.
May	Workman (aged 24) in an engineer's shop at Sheffield.	Practical joke by fellow-workman. Shock from door-handle. Deceased in bad health.
May	Collier (aged 47) at Mountain Colliery, Gorseinon.	Deceased rescued fireman in contact with hauling rope, which had become alive.
June	Machine traveller, Metropolitan Amalgamated Railway Works at Birmingham.	Deceased held a bar of iron which came in contact with frame of electric lamp; 1,000 v.
July 2 ...	Employé (aged 44) at G.W.R. sub-station at Acton, cleaning insulators.	Contact with 6,000-v. wire; both arms burnt to the bone.
July 5 ...	Apprentice electrician (aged 16) cleaning fittings in sub-station switch-chamber at Samuelson's Works, Middlesbrough.	Deceased inadvertently painted live panel; 11,000 volts.

REVIEW OF THE L.G.B. DdepartmentAL COMMITTEE'S REPORT RELATING TO ELECTRICITY SUPPLY UNDERTAKINGS.—II.

Stores Accounts.

Par. 46.—"In our opinion it is essential that full and accurate stores accounts should be kept in all cases where materials are purchased for subsequent conversion or use, and the responsibility for them should be clearly defined. These accounts should form an *integral* part of the book-keeping, and should be so framed as to afford complete touch with the materials from their purchase to their consumption. This requirement necessarily involves a scheme of books and records suitable to the circumstances of the various classes of supplies dealt with; but the forms of the books and records both can, and should, be of a *simple and easily intelligible character*."

Par 47.—"The storekeeper, as such, need keep nothing more than a simple account (in one or more books according to convenience) showing the quantities of each class of materials received and issued to the several jobs; it appears to us unnecessary and inadvisable that he should deal with the values of the materials. He should enter up the debit side of the account from the delivery note accompanying the materials, which he should certify to be correct as regards the quantity delivered. The credit side of the account should be entered up as the materials are issued from the store, and the entries should be supported by issue notes signed by the officers on whose requisition the issues are made. The delivery notes and the issue notes should be forwarded, as soon as may be, to the accounts department of the authority."

Par. 48.—"It is desirable, on general grounds, that the officer in charge of the stores should not be the executive officer who is responsible for their consumption. The observance of this principle secures a check upon the use and allocation of the materials, and relieves the executive officer of the burden of book-keeping. Such an arrangement is no doubt to a large extent impracticable among the smaller authorities, and in many institutions, such as workhouses and hospitals; but in any case where a separate storekeeper is not appointed, the use of the stores should be checked and supervised as carefully as possible by the accounts department."

Par. 49.—"The proper method of calculating the values of materials issued from store is a matter which requires careful treatment. In the manufacturing departments of the Navy and Army respectively, issues are charged either in accordance with a standard rate or on a scale adjusted at frequent intervals. In the case of local authorities, where, as a rule, goods are supplied at a fixed contract price, there is no difficulty in basing the issue values on that price. In addition to the actual cost of the materials consumed, there are a number of incidental items to be charged to the services to which the materials are issued; such items would include charges for the handling, delivery and storage of the goods, and the general expenses of the upkeep of the store-yard. The actual increase in the value of any material owing to labour directly expended on it before issue should be included in the price charged to the service."

Par. 50.—"Unused materials and old materials, if returned to store, should be recorded in the accounts in the same manner as new materials. Undamaged materials should be taken on charge at their original cost; used materials at an estimate of their value."

Stocktaking.

Par. 51.—"A proper system of stocktaking is essential to any system of stores accounts; but the arrangements made in this respect by many local authorities leave much to be desired.

"Stock should be taken by or under the direct supervision of an independent stocktaker, or an officer of the authority, who is not in any way responsible for the custody of the stores. Stocktaking should be carried out at the end of each financial period; but it is desirable to supplement it where possible by a system of partial or test examinations at more frequent intervals.

"The results of the stocktaking should be compared with the stock accounts, and strict investigation should be made into any discrepancies."

It must be remembered that the Departmental Committee in drawing up general recommendations to apply to the whole of the departments of a local authority must include some conditions not applicable to individual departments; it is necessary, therefore, for departmental committees of local authorities to discriminate as to the method of applying the recommendations set forth to their particular departments.

The suggestion that stores accounts leading up to accurate cost accounts should form an integrant part of the book-keeping will revolutionise electricity accounts, inasmuch as it means that the whole of the intromissions of stores must be kept by a complete double-entry system. As far as our knowledge extends, there is only one isolated case (we are open to correction) where stores accounts are kept by such a system, but we can vouch for the accuracy of the method, and the close connection in every detail with the recommendations of the L.G. Board. From this source of information we are enabled to give the following details, which we hope will be of service to those undertakings contemplating the adoption of these recommendations, but it will be readily understood from the nature of these articles that a skeleton outline only can now be presented; we hope, however, as indicated in a prior issue, to be in a position to publish a complete system of accurate cost keeping in the near future, when full details will be given.

The card ledger system appears to be most adaptable to "the circumstances of the various classes of supplies dealt with," and the account should be commenced by writing up the debit side with each item of stock in hand at the commencement of a financial period, specifying quantities and net invoice prices. Undertakings employing direct labour wherever possible would have a large number of these stock items, ranging from hundreds to thousands; it is necessary, therefore, to classify them in order to afford facility of reference. The first classification should be as to locality, *e.g.*, main stores, sub-stores, yard stores, oil stores, and those under the charge of carpenter, bricklayer, boiler foreman, blacksmith, &c. The second classification should be as to affinity, *e.g.*, cables, arc sundries, incandescent sundries, iron and steel, bolts and nuts, tubes, &c., carbon brushes, fabrics, cleaning brushes, stock tools, iron screws, brass screws, copper, lead, brass, &c., and the third classification should be as to sizes, *e.g.*, bolts and nuts 1 in., $\frac{7}{8}$ in., $\frac{3}{4}$ in., $\frac{5}{8}$ in., &c. After complete classification, the cards should be plainly numbered consecutively and entered into a permanent Stock Book, and the net value of each item extended, so that the aggregate sum of all the items of stock will equal the amount balancing the stock account in the General Ledger at the close of the previous financial period.

The account should now be continued, as recommended by the L.G.B., by the storekeeper's entering from certified delivery notes into a Goods Received book in duplicate all items received into stores, whether for stock purposes or direct charges upon work in progress. The duplicate, together with the certified delivery notes, is to be handed, not to the accounts department of the local authority as recommended, but to the Electricity Accounts Department for entry in the Purchases Journal, in which the amounts will be allocated to their proper service from invoices certified by the executive officer responsible for the allocation of all expenditure. The monthly totals of these allocations should then be forwarded to the accounts department of the local authority for posting to General Ledger.

It is preferable that the credit side of the account, as far as the storekeeper is concerned, should be kept on the loose-leaf system. The stores are served out on requisition of the executive officer responsible for their consumption, and are signed for by the workman receiving the goods. The requisition, which should contain quantity, description and job number, is posted direct to Stores Issued sheets, and where it is necessary that more than one officer should requisition stores, the posting should be made to separate sheets for station and mains. The Stores Issued sheets and issue notes are handed each morning to the Electricity Accounts Department (not to the central department) for pricing, extension and dissection. The issue sheets should contain date, requisition number, quantity and description and stock number, with columns for price and extension. The stock number gives the reference to the Card Ledger, to the credit side of which must be posted the quantity used, and *as the card clearly shows the invoice price*, pricing and posting can be done automatically. After extending and totalling stores issued for the day, the amounts are dissected under the various job numbers and balanced with the daily total. The job numbers are then classified under their allocations, and the whole is passed on to the executive officers responsible for the issue of the stores for inspection and certification, and thence to the chief of the department, who can at once check any abnormal expenditure or wastage. A monthly analysis under the various allocations is submitted each month to the accounts department of the local authority, and posted thence to the General Ledger.

If the postings to the credit and debit sides of the Stores Ledger are made daily, it is quite clear that various accounts are in a state of constant balance, and that the permanent Stock Book can be written up at any time for balance-sheet purposes, and also, we would point out, that by the use

of the card system, facility is given to the system of partial or test examinations. It is quite feasible for any independent officer to take a section of cards, referenced by stock number, and examine the actual stock at any time.

We quite appreciate the statement made by the Committee that the stocktaking arrangements of many authorities leave much to be desired, and until such authorities can be brought to look upon stock in the same light as cash, and to impose as strict a surveillance upon the former as upon the latter, stocks will continue to be kept in a chaotic manner.

We cannot agree with the Committee that it is possible to charge all incidental items connected with stores as enumerated by them to "the services to which materials are issued." Storekeeping charges which cannot be charged to any individual item of stock should be charged to general establishment charges, and credit taken at a fixed percentage when making up the service charges at each balancing period. Our space will not permit full consideration of this subject, which is a most important one, and which relates not only to stores, but to wages also, but we would impress upon the Committee the necessity of reconsidering their recommendation before it passes into law.

We commend the principle regarding used materials' being credited to each service as laid down in par. 50. The system of crediting old materials to maintenance account, as set forth in the Board of Trade form of accounts, is a pernicious one, from which serious irregularities have arisen. It should be the duty of each executive officer responsible for the consumption of stores to issue a credit note for *all* materials returned to stores, even if it is undesirable to place a value upon some items, the decision as to value to lie in the hands of the officer responsible for the purchase of all goods for departmental use.

Reviewing the recommendations as to stores accounts and stockkeeping as a whole, we cannot commend them too highly. They will certainly entail a large amount of initial labour to nearly every electricity undertaking, but we know it to be a fact that after the system here indicated is in thorough working order, clerical labour is actually reduced, and the benefits derived fully compensate for the heavy labour incurred in instituting the system.

NEW PATENTS APPLIED FOR, 1907.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

17,817. "Improvements in making electrically-conducting joints in metallic filament incandescent electric lamps." A. C. Hyde. August 6th.

17,830. "Electrical attachment for racking off casks." C. A. Allison. (V. Spietschka, United States.) August 6th.

17,834. "Improvements in electric incandescent filaments for lighting or heating." A. Gray. August 6th.

17,855. "Improvements in or relating to mountings or fittings for tubular incandescent electric lamps." D. Assersohn. August 6th. (Complete.)

17,860. "Construction of a lifting magnet having a magnet core which is to serve as a dropping weight for use with electric arc lamps provided with juxtaposed electrodes." Deutsche Beck-Bogenlampen G.m.b.H. (Date applied for under Patents Act, 1901, August 3rd, 1906, being date of application in Germany.) August 6th. (Complete.)

17,894. "Improvements in electricity meters." Compagnie De Construction Electrique. (Date applied for under Patents Act, 1901, November 10th, 1906, being date of application in France.) August 6th. (Complete.)

17,896. "Improved system of indexing telephone directories and other books." M. S. Benjamin. August 6th.

17,947. "Automatic electrical gong-ringing device for electrical street railway cars." N. Fallek. August 7th. (Complete.)

17,961. "Improvements in printing and sight-reading telegraph apparatus." E. W. Beech. August 7th.

17,968. "Process for electrolytic production of lustrous metallic coatings upon other metals." A. Classen. August 7th.

17,969. "Electrolytic process for the production of metallic dark coating upon metals." A. Classen. August 7th. (Complete.)

17,972. "Improved manufacture of electric incandescent lamps having filaments made from a plastic mass." Siemens & Halske Akt.-Ges. (Date applied for under Patents Act, 1901, August 28th, 1906, being date of application in Germany.) August 7th. (Complete.)

17,973. "Improved manufacture of electric incandescent lamp filaments consisting of difficultly fusible metals." A. G. Bloxam. (Siemens & Halske Akt.-Ges., Germany.) August 7th. (Complete.)

17,993. "Polarised or unpolarised buzzer for telegraphic, telephonic or bell purposes to obviate the use of relays." B. H. Thorogood. August 7th. (Complete.)

18,020. "Improvements in electrical switches." A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. August 8th. (Complete.)

18,022. "Improvements in and relating to controlling devices for electric circuits." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 8th.

18,032. "New form of primary battery." H. E. Fry. August 8th.

18,033. "Improvements in locking apparatus for locking electric light glow lamps to holders." W. J. Bodell. August 8th.

18,044. "Improvements in monophase shunt electric machines." Felten and Guilleaume-Lahmeyerwerke Act.-Ges. (Date applied for under Patents Act, 1901, August 11th, 1906, being date of application in Germany.) August 8th. (Complete.)

18,045. "Improvements in inverted repulsion electric motors." Felten and Guilleaume Lahmeyerwerke Act.-Ges. (Date applied for under Patents Act, 1901, August 15th, 1906, being date of application in Germany.) August 8th. (Complete.)

18,053. "Improvements relating to the manufacture of filaments for incandescent electric lamps." R. Jahoda and Electrische Gluhlampenfabrik "Watt." August 8th.

18,082. "Improvement in carbon electrodes." J. T. Szek. August 9th.

18,101. "Improved process for the manufacture of insulating materials." Wunner'sche Bitumen Werke, G.m.b.H. (Date applied for under Patents Act, 1901, April 29th, 1907, being date of application in Germany.) August 9th. (Complete.)

18,111. "Improvements in insulating material." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) August 9th.

18,152. "Improvements in apparatus for determining the direction of space telegraph signals." J. S. Stone. (Date applied for under Patents Act, 1901, August 17th, 1906, being date of application in United States.) August 10th (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1906.

Method of and Automatic Electron Igniser for Treating Cold Crude Petroleum or any of its Distillates to Obtain an Explosive Mixture for Use in Internal Combustion Engines. D. Martini. 13,840. June 16th.

Electric Driving Gear for Machine Tools and like Machines. A. Wichler and G. Rennert. 15,839. July 12th.

Rests for Telephone Receivers. R. W. Coan. 16,066. July 16th.

Automatic Switching Apparatus for Use in Installations for Electrically Lighting Railway Trains. H. Wright. 16,263. July 18th.

Railway Train Electric Lighting Apparatus. R. H. Martin. 16,590. July 23rd.

Clockwork Switches. F. T. Reid. 16,646. July 24th.

Electrical Machines having Fly-Wheels. Felten & Guilleaume Lahmeyerwerke Akt.-Ges. 17,459. August 2nd. (Date applied for under International Convention, November 21st, 1905.)

Solenoid-Controlled Electric Switches. A. H. Curtis and A. H. Adams. 17,742. August 7th.

Systems of Electric Motor Control. British Thomson-Houston Co. (General Electric Co., U.S.A.) 18,186. August 13th.

Utilisation of Wind Power for Generating Electricity for Lighting or other Purposes. G. Broughall. 18,220. August 14th.

Manufacture of Filaments of Metallic Tungsten or Molybdenum for Electric Incandescent Lamps. A. Lederer. 18,738. August 21st.

Electro-Deposition of Alloys. S. O. Cowper-Coles. 19,411. August 30th.

Self-Regulating Dynamo-Electric Machines. Mather & Platt, Ltd. (G. Rosenberg.) 19,627. September 3rd.

Brushes for Dynamo-Electric Machines. Morgan Crucible Co. and V. W. Speirs. 19,704. September 4th.

Apparatus for the Electro-Deposition of Metals and Their Alloys. D. Roberts, M. K. D. Roberts and E. W. Jaffray. 20,716. September 18th.

Mounting of Dynamo-Electric Machines. F. H. Loring. 20,752. September 19th.

Electric Motor Control Devices. British Thomson-Houston Co. (General Electric Co., U.S.A.) 20,803. September 19th.

Means for Preventing the Spread of Fire in Connection with Electric Wiring. J. Robinson and H. Walker. 21,299. September 26th.

Control of Electric Motors, More Especially Applicable in the Operation of Bulk-Head Doors and the like. British Thomson-Houston Co. (General Electric Co., U.S.A.) 21,253. September 25th.

Electrolytic Manufacture of Metallic Wire, Strip or the like. S. O. Cowper-Coles. 21,583. September 29th.

Control of Electric Motors. British Thomson-Houston Co. (General Electric Co., U.S.A.) 22,347. October 9th.

Refuse Receptacles Applicable for Attachment to Electric Standards, Lamp-Posts and the like. E. A. Brown. 22,464. October 11th.

Speed Regulation of Induction Motors. M. Milch. 22,863. October 16th.

Dynamo-Electric Machines. British Thomson-Houston Co. (General Electric Co., U.S.A.) 22,904. October 16th.

Two-Phase Alternating Current Distribution. H. E. Russell and F. E. Berry. 23,246. October 19th.

Brushes for Dynamo-Electric Machines. British Thomson-Houston Co. (General Electric Co., U.S.A.) 23,444. October 22nd.

Electricity Meters. G. Hookham. 23,602. October 24th.

Electrical Resistance Thermometer. G. W. Johnson. (Firm of W. C. Heraeus.) 23,781. October 25th.

Maximum Demand Indicators for Electrical Measuring Instruments. C. C. Garrard and Ferranti, Ltd. 24,209. October 30th.

Method of and Means for Electrically Driving Printing and other Machines. W. A. Mitchell. 24,239. October 30th.

Magnetic Compasses and the like. W. T. St. Aubin. 26,829. November 26th.

Glass or Lens for Acetylene or Electric Lamps for Vehicles and the like Purposes. J. G. Cockburn. 27,492. December 3rd.

1907.

Slot Switches for Electric Tramways and the like. C. C. Korns. 538. January 8th.

Electric Safety Lamps for Use in Mines. E. D. J. Mallet. 615. January 9th.

Electricity Meters. A. May. 1,663. January 22nd.

Telephones. A. G. Kountz. 1,665. January 22nd. (Date applied for under International Convention, January 22nd, 1906.)

Electrical Maximum Demand or Rebate Indicators. H. S. Hatfield and Reason Manufacturing Co. 2,613. February 1st.

Automatic Electrical Targets for Rifle Practice. S. A. M. Rose and H. B. Crowle. 2,983. February 6th.

Arc Lamps. T. L. Carbone. 3,245. February 9th. (Date applied for under International Convention, March 17th, 1906.)

Production of Electrotypes and Apparatus Therefor. S. O. Cowper-Coles. 4,051. February 18th.

Electric Furnaces. F. M. Chaplet and Soc. La Neo Metallurgie. 4,927. February 28th. (Date applied for under International Convention, March 3rd, 1906.)

Electric Heating Apparatus for Dentist's Instruments and the like. C. N. Lord. 5,937. March 12th.